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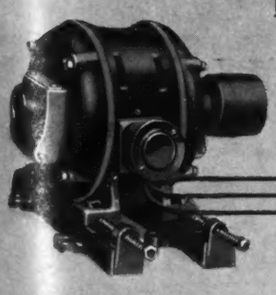
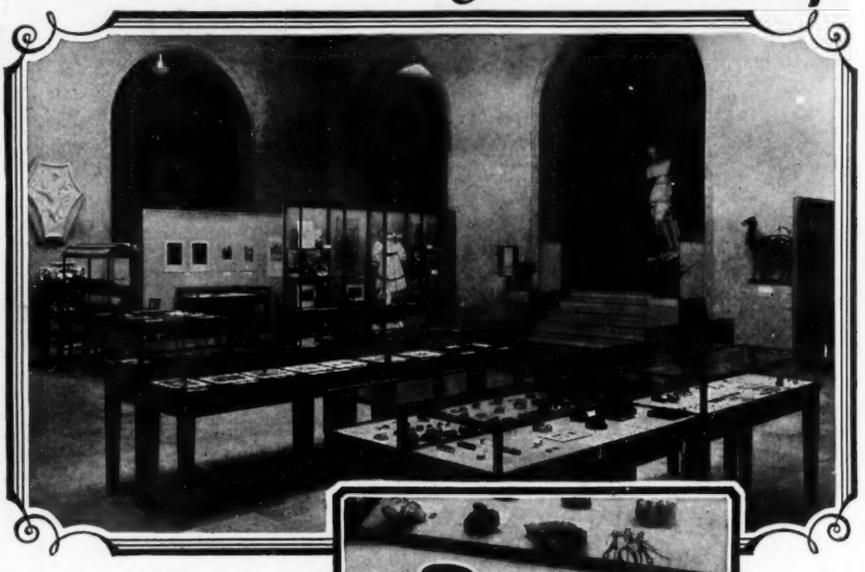


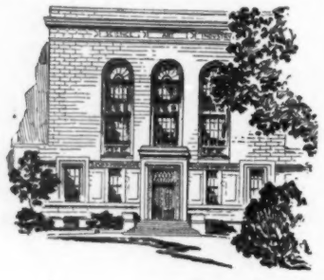
A Museum's Tribute to Modern Craftsmanship

Typical museum exhibits of early craftsmanship.



By JOHN COTTON DANA
Director of
The NEWARK MUSEUM

THIS has long been in my mind: —To make an exhibit of a few of Newark's products in iron or steel or copper or aluminum or other metal. Confine it to small machines, or to small parts of large machines; to things of metal which have been cast, forged, planed, turned, trued and tested until they are accurate to within thousandths of an inch. The objects I have in mind all bear the marks of accomplished workmen, no matter if they are, in a measure, products of automatic machinery. Such an exhibit would call attention to the fact that a product of human skill, no matter how much it may be machine-aided—if perfectly adapted to its purpose, with no waste of metal—is a work of art. We praise a man who paints a good picture and public institutions, like museums, help him to sell his work. Why? Can we not with equal reason praise a man who, after a long study and practice, makes with superlative skill a certain part of a machine?



It may be said that today machines do much of the fine work which was formerly done by hand. They do, and they do much more in a given time than ever could have been done by hand. But to do by machine what was formerly done by hand, we have had to perfect the machines. And who has done that? And who is doing it still? The skilled mechanic, of course. And it is the wonderful work of the skilled mechanic found today in Newark, — that is the thing to which I believe small exhibits such as I have suggested would draw the attention of many and arouse in them wonder and admiration.

We are told by enthusiasts of the antique that in our haste to live we have lost the art of giving to a product the patient skill which craftsmen of older days so often brought forth. I do not speak as an expert in metal work of any kind, but I venture the assertion that never in the history of craftsmanship were metal objects made that were finer, more accurate, more closely fitted to their purpose, than are a good number of those made today.

And here is an exhibit just to my thought; lent to the Museum and properly displayed by the Weston Electrical Instrument Corporation of our city.

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Contents of This Issue

EDITORIALS 1127

FRONTISPIECE—1927, A YEAR OF APPLIED IDEAS AND GRATIFYING RESULTS 1130

ENGINEERING DEVELOPMENTS IN 1927 1131
Trends in power station, transmission and distribution equipments and practice. Industrial apparatus and applications. New fields for inventions and research.

TYPICAL NEW APPARATUS OF THE YEAR.....1137
A pictorial presentation of typical 1927 outstanding developments, the photographs of which speak for themselves.

SUMMARY OF EQUIPMENT DEVELOPMENTS IN 1927....1151
Accomplishments reported by manufacturers during 1927 covering new products developed and equipment on which major developments were made are presented in alphabetical order according to the manufacturer.

LETTERS FROM OUR READERS 1160

DIGEST OF ELECTRICAL LITERATURE.....1161

NEWS OF THE INDUSTRY.....1163

COURT DECISIONS, COMMISSION RULINGS.....1170
NEWS ABOUT MEN OF THE INDUSTRY.....1171
FINANCIAL AND STATISTICAL NEWS.....1172
BUSINESS NEWS AND MARKET CONDITIONS.....1176
ACTIVITIES OF THE TRADE.....1179
ELECTRICAL PATENTS 1180

BUSINESS FACTS FOR ELECTRICAL MEN.....1181

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New Equipment, or Buying for Production

MANUFACTURERS are seeking to get maximum production per unit of factory space and per unit of labor. All industry seeks to use power and modern equipment to attain these ends. Electrical manufacturers and electrical utilities seek to supply the equipment and the power to do the job. They have met with great success and are largely responsible for production economies.

The editors of the ELECTRICAL WORLD have surveyed the manufacturing field to find representative apparatus that meets the needs of modern industry. They found a multitude of devices, control equipment and processes. They present in this issue a pictorial survey of new equipment which is indicative of trends. They also present page after page of new or improved apparatus which manufacturers have offered this year. The evidence is conclusive that electrical manufacturers are alert and progressive.

It is a big task to note all the new equipments in one issue. It has taken a long time, competent and experienced editors and the hearty co-operation of manufacturers. The results should interest all electrical men and increase their pride in the electrical industry.

STATISTICAL AND FINANCIAL REVIEW

In the Jan. 7 issue of the ELECTRICAL WORLD the editors will present detailed data for the entire electrical industry. Pertinent facts have been assembled during the year, and much time and effort have been spent in order to surpass all previous issues in value to the industry.

Advertising Index—Alphabetical, 136; Classified, 130, 132, 134; Directory of Engineers, 68, 69; Searchlight Section, 70-76

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 90 — *New York, Saturday, December 3, 1927* — NUMBER 23

Success Attends International Radiotelegraph Conference

VERY encouraging not only to the practitioners and amateurs of wireless communication but also to the believers in international friendship and harmony has been the International Radiotelegraph Conference which closed last week in Washington. There eighty nations sent delegates to draft a treaty binding virtually the whole civilized world on all points affecting international conflicts over the use of the ether for telegraphic messages. The room for disputation was endless. Right at the start arose the difficulty occasioned by the fact that in the United States radio as an art and an enterprise is in private hands while in nearly all the other nations it is under rigid governmental control. This obstacle to agreement was surmounted, and all other differences of viewpoint were harmonized after they had been debated in a scientific spirit by 150 committees whose deliberations were spread over seven weeks. As Secretary Hoover, in his admirable summary of the accomplishments of the conference, over which he presided, said, the treaty in which its proceedings culminated sets another milestone in the progress of international relations. It is a signal victory over the tendency to anarchy which, naturally prevalent in domains that belong to every nation and hence to no nation, has spread in these latter days from the sea to the air and which, uncombated, would destroy or maim the finest achievements of the human brain—those which transcend national boundaries and inure to the progress of mankind as a whole.

* * * *

Invention Breeds Competition

INVENTIVE genius has full opportunity in the electrical industry. It is the foundation upon which past achievements have been built, and it offers most hope for future progress. In the complexity of the modern electrical industry invention still persists and sends new lifeblood coursing through commercial channels. Every new invention does not stand out like a mountain peak from a plain. It cannot do so, because it is one of many mountain peaks. This issue of the ELECTRICAL WORLD carries evidence of more inventions and developments than can be shown for several years in the nineties. New discoveries are so numerous that they are now commonplace in the public mind, and the future holds promise of a continuation of this progress.

The multitude of inventions and developments each year has an important commercial bearing. It means that no manufacturer or group of manufacturers can control the markets; it means that no manufacturer of a piece of apparatus can be content to drop development and research work. If he does, another manufacturer may steal his market because he has a better machine available. Invention stimulates competition and keeps manufacturers awake to industry needs.

Commercial conditions are conducive to invention in the electrical industry. In the home and in the factory many tasks still await the electrical machine or method; manufacturers are competitive, seek business in the markets and try to get the commercial advantages accruing through the introduction of a new or better machine, and, best of all, any inventor of a needed machine or method finds a welcome at the hands of financiers and manufacturers. History has proved that money put into a needed invention is profitable business. Business men's minds are favorably inclined toward electrical products and financiers have enormous funds which are hunting profitable investments. This is truly the golden age for the inventor.

* * * *

Machines as Emancipators

MACHINERY is writing an emancipation proclamation for the American people. Through its application and the adaptation of electric power Americans have gained economic and social freedom. Each new machine or new method introduced causes technicians and workers to think of means for applying it to their tasks. Americans are converts to a policy which takes muscle work out of a job and puts mind work into it. The worth of any industry is measured by its use of machinery and its readiness to substitute improved machines and methods for old ones. The electrical industry has had the courage to keep up to date. It has met demands for machines and methods as the industry grew, and it has discarded mechanically sound boilers, generators, waterwheels, motors and other devices when improved machines were developed. This policy has made for better business and has brought progress.

All credit should be given to manufacturers who have supplied the machines for the electrical industry. They have met the increased requirements of a rapidly growing industry of increasing technical complexity. They have poured their minds and money into research and development work in order that they might improve old machines and design new machines. Through intimate association with users of electricity they have had a knowledge of industry needs and have worked to supply them. Often they have discarded existing business and suffered a money loss in order to introduce a better product. As shown in this issue, manufacturers are still replacing carbon lamps with tungsten lamps and steam engines with steam turbines.

Manufacturers are essential to the growth of industry, for they make the tools with which growth is accomplished. Industry prospers as they prosper. Manufacturing policy should incorporate a plan of contributing to development and research in direct proportion to the prosperity enjoyed. Buying policy should include pay-

ments for apparatus of sufficient magnitude to maintain a prosperous group of manufacturers in the industry. Both policies should be adopted in the electrical industry in the largest measure, for it is growing and expanding at a rapid rate. It needs new machines and better machines. Buyers and sellers must sign the emancipation proclamation as partners.

* * * *

A Modern Cyclops

THE frailty of human faculties is nowhere more evident than in the interpretations which are made of visual phenomena. With due regard for the findings of the psychologists, where a positive indication is needed a relatively reliable estimate may be made of apparent images, but in comparative work the crudest of estimates are subject to overwhelming errors.

Photometric measurements have suffered through the inability of the operator to judge intensity values of illuminating effect with any assurance of regular reliability, but the development of the photo-electric cell photometer may take much of the guesswork out of this important phase of lighting work. With the most recent device developed for this purpose, the lamp whose lumens are to be measured is placed in the customary manner in a commercial spherical photometer of the usual type. The integrated light of the lamp passes through a test plate and filter of the proper characteristics, falls on a light-sensitive film which covers the interior surface of a photo-electric cell and causes the film to emit electrons. A suitable potential is placed across the cell, and the resultant electron emission or current is measured by a galvanometer or micro-ammeter. The characteristics of the cell may be so varied that the electron emission will be proportional to the light and the intensity become measurable directly.

Here, at one blow, go all the factors of uncertainty, working standards, bright spots, dark photometer rooms, and what is most important, the errors due to all-too-human frailty. A learned man of science once stated that if a workman offered him an instrument as faulty as the human eye, he would unqualifiedly reject it. Modern engineering is well on its way toward overcoming the many imperfections of visual perceptivity.

* * * *

The Industry Sales Conference Makes a Good Start

A VERY hopeful start has been made by the industry sales conference which the four major electrical national associations and the League Council have brought together. The mere fact of its having assembled itself stimulates enthusiasm. For it is the first time that official representatives of the power companies, manufacturers, jobbers and contractor-dealers have ever sat down together to talk about "our market" and "our business." It seems a very radical step after the long history of group activities and class conflicts that have so marked the electrical industry. And the fact that the local leagues were invited to sit in the conference on an equal footing with the great associations also indicates a new kind of thinking among electrical men.

The first meeting of the conference, of course, has not recorded much accomplishment. It could not be expected. But it has gone to work in a positive way. It elected as its chairman the president of one of our prominent manufacturing companies, a young man of action and ability. It appointed as its vice-chairman the experienced sales head of our largest jobbing organization. It made the managing director of the Society for Electrical Development its secretary. And this was sensible because, although the S.E.D. has nothing whatever to do with this sales conference, other than to be helpful if it can, it is well that there should be a liaison, since the conference will naturally want to utilize the society in any program it sets up. And two resolutions were passed to definite purpose—setting as the first objective of the conference the development of a broad industry program for the promotion of more adequate housewiring, and recognizing that the present status of the housewiring contractor presents a problem which must be faced.

The broad problem has been broken down into six parts and committees have been appointed to study and make recommendations. The personnel of these committees is such as to give promise of achievement. Best of all was the attitude of the conference, in the frank admission that here was a group possessed of unprecedented opportunity for service to the industry and the complete agreement that they could do no less than grapple with the job in a determination to find the way to a solution. The conference should not hesitate to call upon any man of the industry—no matter how exalted or how busy he may be—to aid in any way that may be needed in the working out of these problems and this program.

* * * *

Standardization and Progress

MANUFACTURED products for the electrical industry should change with changing industry needs and conditions. But changes cost money and take time. Changes may be desired by single groups in the industry or may be suggested by local conditions only. Manufacturers cannot be expected to embark upon a program which calls for producing a different product for every buyer. But neither should they standardize so rigidly that inflexibility results and progress ceases. Buyers of apparatus also have problems in connection with using standardized instead of special apparatus. Too frequently they demand special equipment at a price corresponding to that of standard equipment. In other cases manufacturers will not undertake to develop new apparatus which is needed. In the final analysis the buyer is chiefly responsible for the degree of standardization that can be had with apparatus which is in production, and the manufacturer is chiefly responsible for the development of new or better apparatus.

Standardization of apparatus in the electrical industry is nothing to brag about. This condition has its roots in the electrical systems developed in this country. Historical influences give the electrical industry a direct current and an alternating system, systems with different frequencies and systems with different voltages. Local service conditions or local economic conditions have dictated the use of motor-generators and of rotaries, of direct current and of alternating current, of sleeve-bearing motors and of ball-bearing motors, of steel poles and of wooden poles, of a large generator and of a small generator, of a tap-changing transformer and of one with a tertiary winding. Variations in service standards in the industry, interconnection of properties and other developments which mean progress have reacted, at least temporarily, to create less standardization in apparatus.

The domestic, commercial and industrial fields of application of electricity are so large, change so fast, are so complex and are so interlinked that a group mind is necessary to grasp them. Standardization proposals and proposals for new apparatus should clear through a functional organization which represents this group mind. These proposals should be studied to determine their value and to determine whether they would be more valuable if modified. This functional group would check any tendency to depart from an industry program which means ultimately a greater degree of standardization in apparatus. The proper sharing of development costs between buyers and sellers could also well be studied by such a body. It need not be concerned with making standards or carrying out proposed developments. It should not prevent a buyer from getting a special piece of equipment at a special price, nor should it stifle invention and development. Publicity would be its best tool and industry suggestions would make up its raw materials. Evidence increases that such a clearing house is needed in the industry, and industry executives could well consider developing this agency as a part of an industry standardization program.

* * * *

Around-the-World Radio Signals

IT IS not so many years since the distance to which radio communication signals could be transmitted was a serious limitation to the commercial application of the art of radio transmission. The overcoming of this difficulty was accomplished in relatively short time by means of receiving instruments of greater sensitivity and transmitting stations of higher power; so that now we consider distance is no limitation.

Interesting evidence that developments of this character may overshoot themselves is indicated by recent experiments between radio stations in Germany, South America and the United States. It had been noticed for some time that in certain stations signals were repeating themselves at short time intervals with a consequent blurring and confusion of the subsequent signals, thus lowering the purity of the received message. The experiments indicated were carried out to investigate the cause of this repetition. Oscillographic records were taken which permitted an exact knowledge of the amplitude of the original and subsequent signals and the time interval between them. In some cases triple signals were found. The observations have pointed to the very interesting conclusion that the repeated signals may be due either to the passage of the original signal around the earth the second time, or to its passage in the reverse direction from the sending station, or to both paths of propagation. The time intervals invariably are of the order of tenths of a second, and the velocities of propagation indicated are of the same order of magnitude, although somewhat less than the velocity of light. An additional indication from the experiments is that a directional antenna may give out a reverse signal of considerable intensity, which, on the opposite side of the earth, has a considerable fraction of the intensity of the direct signal.

Investigation and study are proceeding with the purpose of finding a method to eliminate these repeated signals of overzealous transmitting systems. So far no remedy is proposed, but one may be confidently expected, in view of the intensive efforts which have always characterized this most interesting field of electrical activity.

The New Competition— What It Means to the Industry

WE HEAR a lot nowadays about the "new competition." It has become something very real in American industry and it deserves the very thoughtful interest of electrical men. What is this so-called "new competition"? It was well pictured recently by Vice-President J. M. Curtin before the Apparatus Division of the National Electrical Manufacturers' Association.

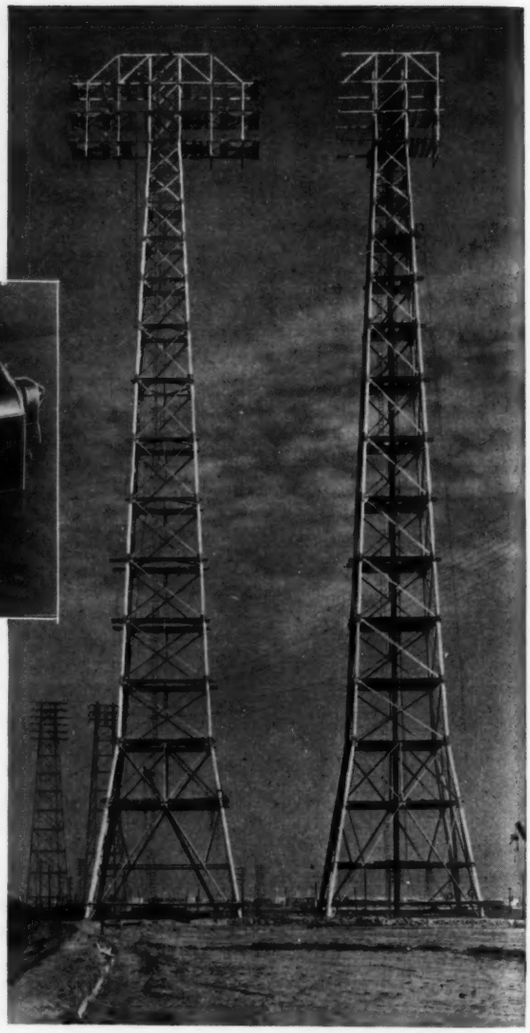
The quickening tempo of American life, he said, has brought great variation in the rate of growth of many industries. In the last decade the total volume of industrial production has increased 34 per cent, about one-half of which is due to growth of population. But people are living faster, spending faster, changing faster in their habits and their tastes. And so in this decade, while population has increased 16 per cent, the consumption of shoes has grown only 10 per cent against 325 per cent for automobile tires. The consumption of cigars has fallen 5 per cent while cigarettes have increased 230 per cent. Newsprint has increased three times as fast as book-paper consumption. The sale of silk has grown more than six times as fast as the sale of cotton goods. And there are many other examples that come readily to mind.

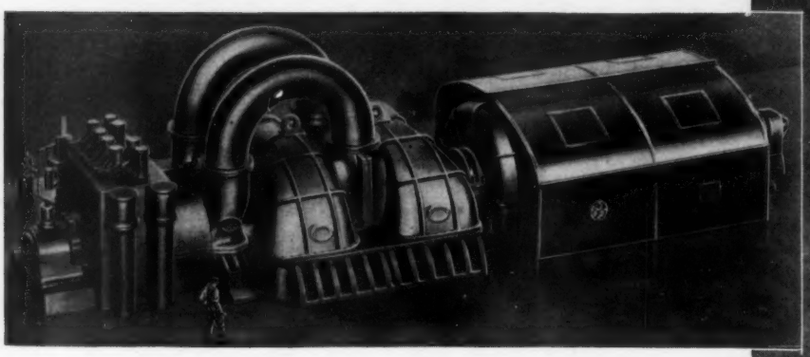
Meanwhile, the use of electric power has shown a rate of increase of 145 per cent. But, according to the statistics of the National Electrical Manufacturers' Association, last year only 61 per cent of the reported shop capacity utilized in manufacturing the products of its members was employed. For instance, for large motors it was 54.5 per cent and for small motors 62 per cent. And at the same time the power companies serve some sixteen million residence customers with an average load factor of about 15 per cent. And these homes that spend $488 a year on automobiles and gasoline, $100 a year for tobacco, $87 a year for furniture, $50 a year for ice cream soda and $48 a year for candy appropriate but $30 annually for all the comforts, conveniences, utilities and economies which electricity offers. What is the reason?

The reason is that the automobile manufacturers, the florists, the raisin growers, the foundrymen, the book makers, the machine-tool builders, the laundries, the radio manufacturers and innumerable other groups in every field have gone into the marketplace in recent years—as industries—and talked the laggards out of their position in the public interest and the public taste. It is the new dominant competition between industries that is fast taking the place in modern business formerly held by the competition between individuals. And while the power companies have been absorbed with their problems of engineering, operating and finance, and while the electrical manufacturers have been engrossed in the problems of engineering and production, and while the electrical jobbers and the contractors and the dealers have been thoroughly engaged in the pleasurable activities of keeping up with the ever-expanding growth of the electrical business, they haven't noticed what was happening. Then suddenly comes the passing of the peak of the old era of growth by accumulating customers, and the electrical industry is also thrown into the midst of the marketplace, dependent for prosperity upon its ability to sell. Very naturally there is much bewilderment. But the industry must think it through, for from now on its growth will be dependent not primarily upon the progress of engineering, but upon commercial proficiency in the new competition.

1927

A Year of Applied Ideas and Gratifying Results





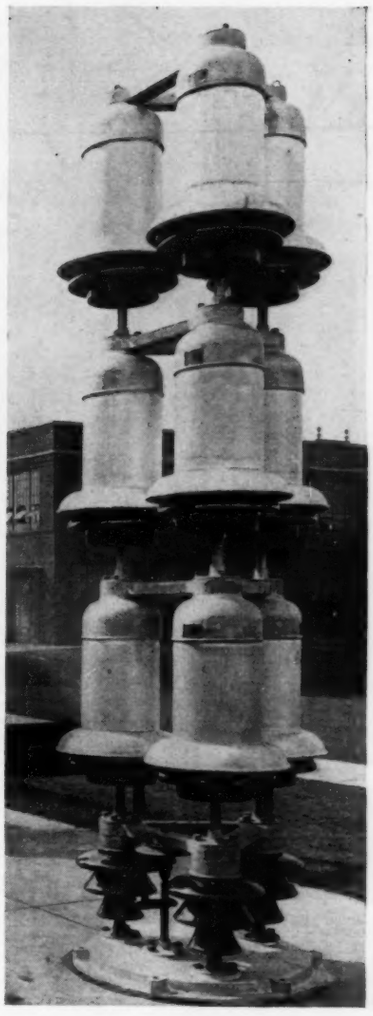
DURING the past year manufacturers have produced new equipment and improvements of old equipment better to meet users' needs. Utility companies have incorporated new ideas and apparatus in their systems and have checked design predictions with gratifying results.

Outstanding engineering developments and trends are recorded in the succeeding article. Following this are pictorial presentations of typical new equipment and a summary of manufacturers' developments.

Above are shown the anticipated appearance of the 160,000-kva. single-shaft New York Edison turbo-generator and the 310-ft. towers carrying 220,000-volt Southern California Edison lines. Below are Commonwealth Edison rectifiers serving the Illinois Central Railroad.

Engineering Developments in 1927

Trends in power station, transmission and distribution equipments and practice. Industrial apparatus and applications. New fields for inventions and research



110,000-VOLT ELECTROSTATIC COUPLING FOR CARRIER-CURRENT ON PACIFIC GAS & ELECTRIC COMPANY'S SYSTEM (OHIO RBASS COMPANY)

Couplings are also being furnished for double this voltage, having twice as many tiers and twice the number of units per tier.

EACH year brings new inventions and applications into the electrical industry and records improvements in past practice. Outstanding new things this year include the operation of 132,000-volt underground cable in New York and Chicago, the first use of transatlantic telephony, the world-wide application of beam-radio stations and the introduction of television as a commercial business. The development of alternating current and rectifier tubes have been outstanding in the radio field.

In addition, many improvements in older methods and equipments may be recorded by each branch of the electrical industry. Each year brings into economic realization bigger apparatus and larger operations. Experiences with existing installations bring about changes for the better in the designs of new apparatus, and old ways of doing things give way to new methods that are based on a more intensive study of service and application possibilities. There is no indication of a static condition.

Power Developments Stable

During the past year many new power stations that incorporated new ideas and equipment were placed in operation. The operating performance of these stations has been checked against design predictions with gratifying results. There is every reason to believe that large power stations can now be built to operate on from 12,000 to 14,000 B.t.u. per kilowatt-hour at an installation cost of about $100 a kilowatt, unless difficult foundation conditions, high-cost real estate or other contingencies exist. This rapid development in steam station economy has placed a heavy economic handicap on the value of hydro developments.

In the hydro-electric field engineering practice is quite well perfected. The prospects for large development at Boulder Canyon, on the Tennessee, and at Niagara Falls, on the St. Lawrence, have become political playthings and the year records plenty of argument but little positive action. The 400,000-kw. Conowingo project is under full headway; it will use eleven 60,000-hp. waterwheel units and represents many advances in practice. In the West, in Canada and in the South several large hydro stations have been built or are building. Cavitation of waterwheels still gives trouble. Better and larger units for wheel, propeller and impulse hydro equipments are available and their efficiency in operation has been improved.

In steam station developments the installation of the 1,200-lb. boiler and turbine unit at Edgar station has proved successful and installations at equal or higher pressures are contemplated for other stations. The temperature of steam is about a maximum at 800 deg. F. with existing materials, and indications point to a greater use of higher pressures rather than higher temperatures in future stations. Another promising development is the news that Hartford is to have a 20,000-kw. mercury turbine installation because experience with a smaller unit of this type has been so successful.

A great amount of discussion has taken place on coal distillation as part of power production. The demand for and low market price of byproducts and complexity in refining and distilling equipments have led to a general agreement that there will be no large-scale operations in this country for some time. In the meantime a sufficient number of small installations continue to be made to keep American power men abreast and even ahead of developments in coal distillation in other countries.

Boilers and Furnaces

Some interesting experiences and installations have been had with boilers and furnaces. Pulverized-fuel equipments aggregating more than 2,500,000 kw. are in

LOW-WEIGHT, SMALL-BASE SNOW TOWER FOR HILLSIDE CONSTRUCTION ON 240,000-VOLT LINE OF GREAT WESTERN POWER COMPANY (PACIFIC COAST STEEL COMPANY)

operation in public utility plants. A unit type pulverizer of 15 tons has been placed in operation at Cahokia. The unit-type installation and turbulent or semi-turbulent burners seem to be favored for the large station in preference to the central or bin system, provided unit pulverizers of sufficient capacity are developed. Stokers hold their own with pulverized fuel, and large stokers with many improvements have been placed in recent stations. Air preheating up to 500 deg. F. has proved itself. The trend is toward automatic combustion control and the use of equipment at high ratings.

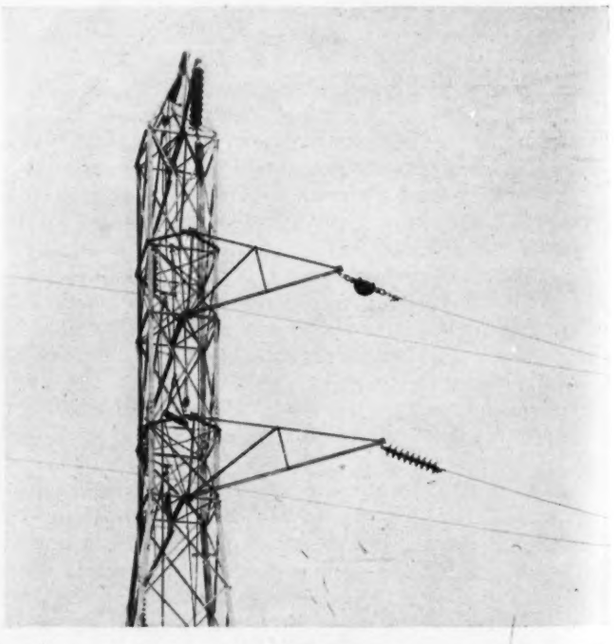
The well-type boiler and furnace with Bailey walls has been operated at high rating successfully by the Buffalo General Electric Company. The New York Edison Company reports good operation of the Murray all-metal furnace. A combustion generator at Zilwaukee is reported to operate satisfactorily. Other stations with normal furnaces, refractories and incomplete water screens are reported as operating well. Thus very different designs of furnaces are in operation, and this year should enable power engineers to determine upon a choice of equipment for future stations. The characteristics of the fuel and the operating conditions are dominant factors in the decision as to station design.

Turbo-Generators Larger

With power stations in New York and Chicago designed for 1,000,000 kw. or more, there arose a demand for large turbo-generators. Multiple units rated at 180,000 to 208,000 kw. capacity are being built or are designed by the General Electric Company, the Westinghouse company and the American Brown-Boveri Company. A single shaft General Electric machine with one generator for a tandem-compound turbine is rated at 157,000 kw. and represents the peak in generator size. It will be installed in the East River station. For very large generators there is a tendency toward higher voltages as indicated by the adoption of 23,000-volt generators at the State Line station. Several new plants are going to install small 1,200-1,400-lb. steam-pressure turbo-generators in addition to larger units using lower pressures. The new designs of turbo-generators have a high efficiency over a wide range of load and are equipped with multiple taps for extraction of steam for feed-water heating. Generator efficiency has been improved by reducing losses and by the use of better steels. The use of hydrogen cooling is also expected to give more efficient results. The tendency is in the direction of larger units operating at higher voltages and owing to the new form of welded construction it has been possible to ship large units which have been completely wound at the factory. The trend of design has also been to the elimination of machine work with a consequent reduction in costs. Steam turbines with buckets and nozzle partitions of corrosion-resisting material throughout the machine also have been supplied.

Auxiliary Supply and Equipments

Alternating-current equipments and controls for auxiliary power systems in large stations have made great headway during the past year. A 2,300-volt supply for auxiliaries is favored more and more. Steel cubicles or oil-and-compound-filled equipments are favored for these installations. Controls for auxiliary motors have been improved to the degree that desired ranges in speed can be had and the equipments stay on the line when short-time interruptions occur. The direct-current auxiliary system remains in most stations for use with wide speed range auxiliaries, for operation of switches, for excitation and for use with combustion equipment and other devices. With the growth of interconnection and two or three sources of supply to a given power station, the use of house turbines has decreased, especially where extraction steam from main units heats the feed water. Shaft-end auxiliary generators, transformers in generator leads



HINGED CROSSARMS ENABLE LIGHTER TOWERS BY MINIMIZING TORSIONAL STRAINS CAUSED BY BROKEN CONDUCTORS (RITER-CONLEY)

and bus transformers are major methods for getting the auxiliary power. The new East River station with all-steam auxiliaries went into operation this year as an exception to the general use of electric auxiliaries.

Switch-House Developments

For the large station the isolated-phase switch-house arrangement has become accepted practice. Newer installations are notable for the care with which the phases are isolated from generator to outgoing circuits and for the care with which the fault bus is installed. It has become good practice to separate the switch house from the power station and the principle of remote control and signaling has been carried out extensively. No great changes in design have occurred with respect to breakers, relays, meters and other switch-house devices. Vacuum-tube synchronizing and relay devices have come on the market. It is considered good engineering to insulate all exposed copper, and safety precautions receive thorough recognition.

Reports from Waukegan and one or two other installations are to the effect that compound-filled, armor-clad switch-house installations are operating satisfactorily. This type of switch gear seems to be gaining in favor and its ultimate field of application depends largely upon costs as compared with alternative installations.

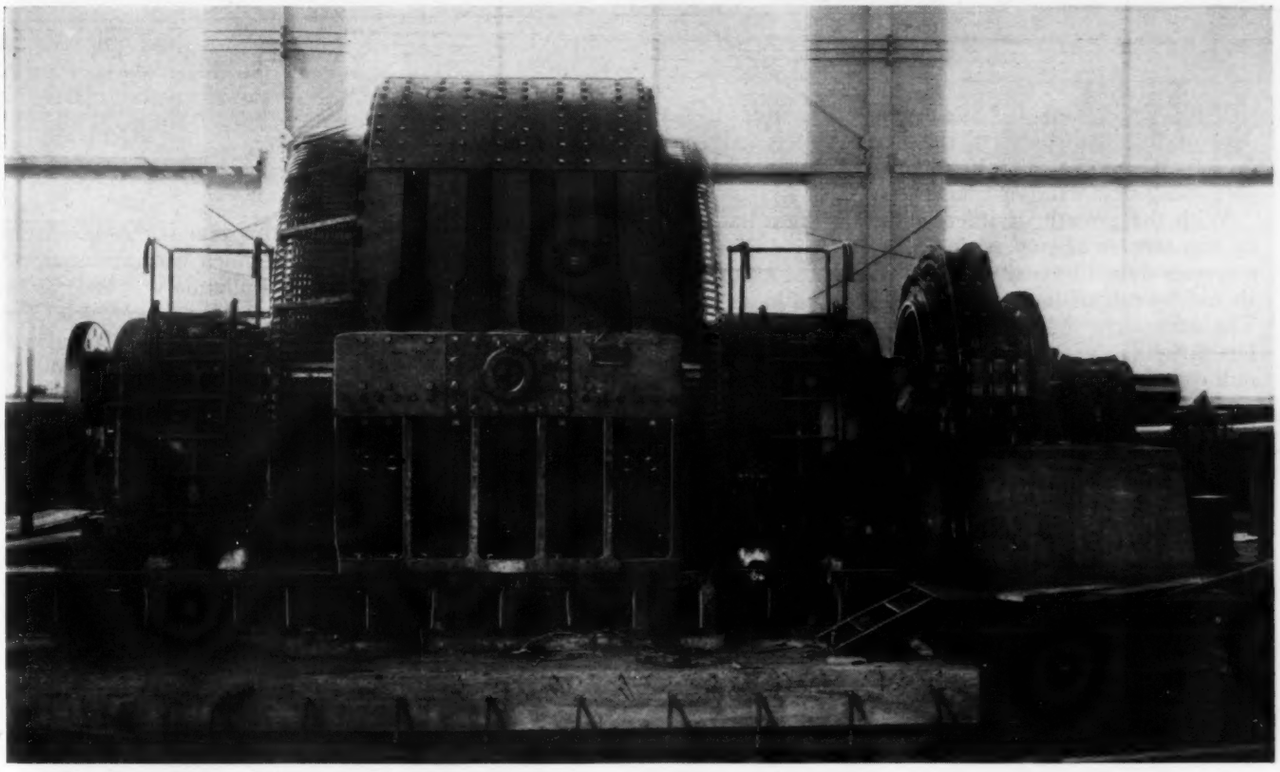
Transmission Booming

Interconnection has become the slogan of the industry and has grown by leaps and bounds. In all sections transmission lines have been built with the primary object of getting interconnections. In the East, the Philadelphia Electric Company, the Pennsylvania Power & Light Company and the Public Service Electric & Gas Company started a major 220,000-volt interconnection. In the South, the Southeastern Power & Light Company has been active with transmission line building. In the West, the previous landmarks in interconnection have been passed. In the Chicago pool, large interconnections have been made. It is a literal fact that copper wire now reaches from Chicago to New Orleans and to Boston, and from Montana to southern California.

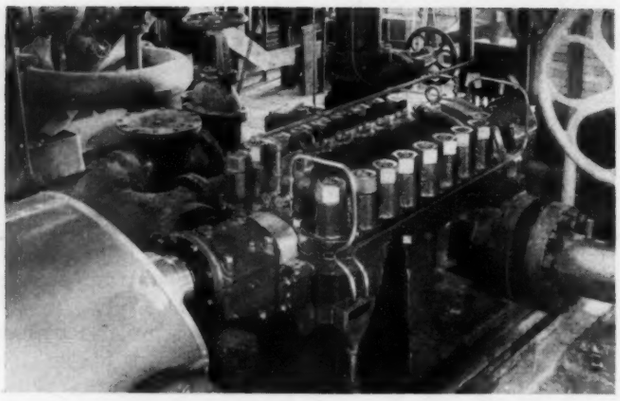
Despite the conception of the public, these interconnections do not involve the transmission of large blocks of power over great distances. Instead, they serve to relay power and act as emergency power channels in step-by-step building programs or in the event that trouble arises on a system.

The growth of interconnections has been accompanied by technical problems and developments. It is desirable to get maximum power over a given line; it is desirable to hold a system in synchronism when a part is in trouble, and it is desirable to control wattless energy and voltage. To get system stability, high-speed excitation systems have been developed, governors have been improved and short-circuit characteristics of generators have been changed. To control wattless, maintain regulation and increase the power capacity, synchronous condensers—the largest ratings being the 50,000-kva. units bought by the Southern California Edison Company—have been used more frequently.

To secure reliable service, towers have been made stronger, clearances greater and insulation factors larger. Debate still persists on lightning protection, but agreement is had that the ground wire is advisable on high-voltage lines. Relaying has been speeded up and made more accurate and the development of good ground relays has made it possible to operate systems with limiting resistances in the ground connection whereby fault currents are reduced in magnitude and breaker duty is decreased. Insulators are very satisfactory and on 220-kv. lines it is considered economical so to insulate the line



100,000-KVA. GENERATOR FOR TESTING OIL-CIRCUIT BREAKERS ADDS TO RESEARCH FACILITIES (GENERAL ELECTRIC COMPANY)



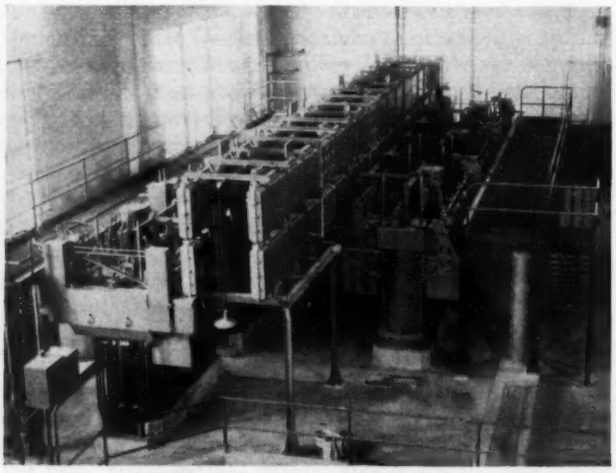
2,300-HP. TURBINE-DRIVEN BOILER-FEED PUMP FOR HIGH-PRESSURE (1,600 LB.) EDGAR STATION AT WEYMOUTH, MASS. (INGERSOLL-RAND)

that service hazards from lightning are reduced to zero. Use of the klydonograph, the Dufour oscillograph and high-speed photography has increased and makes available many new data on transients.

With the growth of interconnection there has grown up two schools of engineering. In one it is believed that a system should be tied together loosely and a faulty part should be cut off instantly. This is called loose linking. The other school believes in a solid interconnection or bus structure with all stations and lines operated as a unit system. The one school calls for very high-speed oil breakers, the other for very large-capacity oil breakers. In one system high-speed relays such as vacuum-tube types are desired and the switching is done largely on the high-tension side of transformers. The other school uses time-delay relaying and low-tension switching predominates. No definite conclusion can be made, because local conditions of operation and installation differ greatly, but 1928 should give positive operating results on the two types of system.

Substation Trends

Outdoor switching and substations continue in favor. They are marked by a greater degree of standardization, larger clearances, gang-operated air-break switches, remote controls and a better arrangement of oil breakers and transformers. Safety precautions are taken in greater degree. The three-phase transformer unit gains



ARMOR-CLAD SWITCHGEAR FOR THE 15,000-VOLT CIRCUITS OF THE PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS INCLUDED FIVE 3,000-AMP. AND TWO 600-AMP. UNITS WITH 1,500,000-KVA. RUPTURING CAPACITY (ALLIS-CHALMERS)

in favor. In several cases overhead structures for substations have been eliminated and underground cables with safety potheads and testing facilities are employed instead.

Both the suspension type of bus and the supported-bus structures are used. Among the advocates of the supported bus are the Southern California Edison Company and the Public Service Electric & Gas Company. Remote-controlled and gang-operated disconnect and air-break switches gain in favor. Complexity is being introduced by the use of tap-changing transformers, frequency changers, synchronous condensers, adjustable-ratio transformers and other equipment incidental to the interconnection of systems that differ in installation, voltage and operating practices. During the year one manufacturer built a total capacity of transformers in excess of 900,000 kva. arranged for load ratio control. The increasing use of high-voltage cables has led to the development of transformers equipped with potheads for direct connection to the cables. More and more the substation is becoming the center of system activity, for it is the control point of energy that arrives from many directions and sources.

An interesting development this year is the installation of a 32-kv. outdoor substation which uses armored, oil-filled switch gear. This first installation was built by the General Electric Company for the Public Service Company of Northern Illinois. About eight or ten armor-clad installations now exist or are projected for utility substations. Most of these use the Reyrolle equipment. The oil-filled type is a recent development. More experience will determine the economic field of application of this type of substation equipment.

In several substations supervisory control equipments have been used, and the use of this control is increasing. Several types of supervisory equipments are available and developments have been rapid during the year. The coupling condenser, cable-type condenser and capacitance transformer in conjunction with telephone and radio equipments have placed new tools for control and communication at the disposal of system operators. The cost of the coupling and power required for communication or signaling are important factors.

In lower-voltage and industrial substations there has been an increased use of the outdoor type of steel-inclosed cubicles. Standardization has been in vogue in all parts of the country and reports indicate that very satisfactory progress has been made.

Mercury-arc rectifier substations for railroad electrification in Chicago and for industrial service have been installed and operated successfully. Some operating difficulties have been encountered that have been ironed out. Insufficient volume in manufacture and lack of operating data over a sufficient period make it difficult to predict the economic field of operation of this new device. For 600-volt service and above it has proved its technical competency to do the work required. Very rapid developments indicate a promising future for this comparatively new substation device.

Distribution System Changes

The general trend in distribution is toward higher voltages. In some localities 13,200-volt circuits are used in an infiltration process to serve heavy loads and a general revamping of systems has resulted in the widespread use of the 4,000-volt, four-wire, three-phase systems. Networks for heavy-load areas have been installed in several cities and operating reports are favorable. The net-

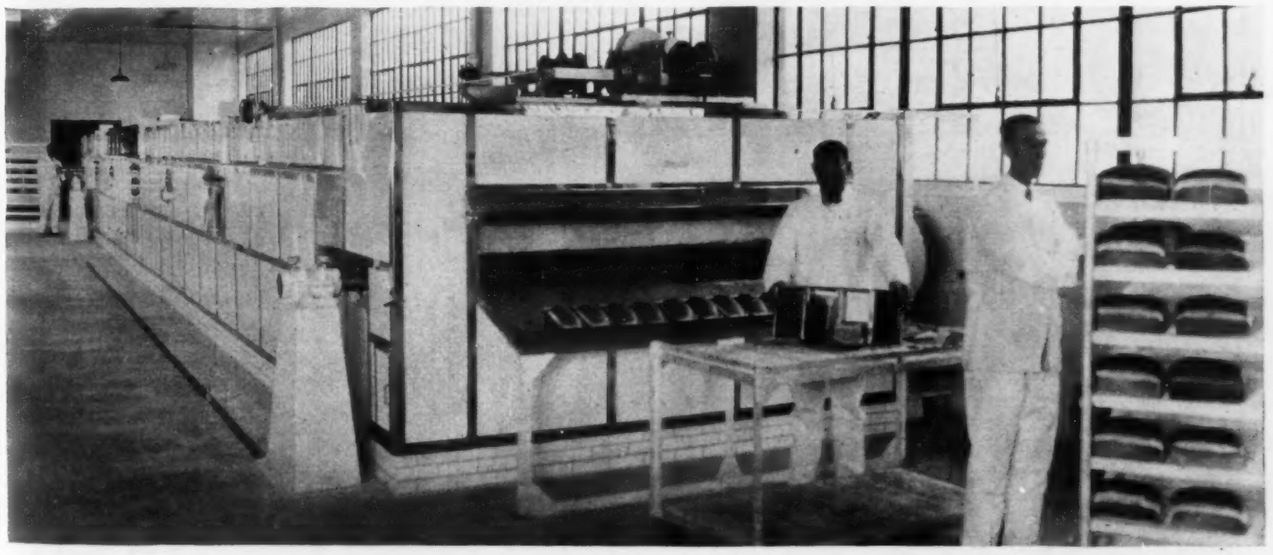
SMALL MOTORS ARE BEING CAREFULLY STUDIED FOR SILENCE (WESTINGHOUSE)

work switches have functioned well and no major trouble has been had with motors used on the networks. The extension of underground alternating-current network systems has resulted in the development of subway transformers as large as 500 kva. arranged for direct connection in the primary and secondary cables. Some difference of opinion and practice exists as to voltage and number of phases, but the three-phase, four-wire, 120/208-volt system predominates.

More accurate design of systems, better loading of transformers and circuits and the reduction of losses are major tendencies in distribution. The distribution substations have developed as comparatively small underground stations for network supply, as large substations from 15,000 to 60,000 kw. in size for general system supply and as small automatic or semi-automatic stations for railway supply and for lightly loaded districts. Reclosing breakers are used freely in these substations. Automatic substations are proved devices for many locations and are favored by many properties. The use of supervisory systems and the adoption of automatic principles in substation design grow apace and make for better service.

Industrial Developments

In process industries, in general construction and in manufacture, electricity and electrical equipment are used more and more. During the year the electrochemical and electrometallurgical industries have gone into electrical processes rapidly. The Anaconda Copper Company and others have developed electrodeposition of zinc, lead and white lead on a commercial scale. The Eastman Kodak Laboratories have developed an electrodeposition process for reclaiming rubber. Indigo is reduced by electricity and copper, and other metals can be had in pure state only by electrodeposition. Batteries for this service have been developed and also motor-generators and rotary converters of large size. In the production of carbide, aluminum, carborundum and other chemical and industrial products electrical processes hold the field.



THIS 2,700-LOAF BAKE OVEN OF THE CUSHMAN BAKING COMPANY WITH ITS AUTOMATIC CONTROL AND TEMPERATURE CHARTS IS REPRESENTATIVE OF TENDENCY TO USE ELECTRIC HEAT (EDISON ELECTRIC APPLIANCE COMPANY AND LEEDS & NORTHRUP)

The steel industry continues to use electricity in large quantities. Standardization of motor dimensions and the greater use of ball-bearing and roller-bearing motors characterize this year in steel mill application. New refinements in control and in modifications of older drives also have made possible maximum production from a series of steel mills operating in unison. Electric furnace refining of high-grade alloy steels continues to increase.

Arc welding has come into its own during the year. Frames for even large rotating electrical apparatus are now welded. Steel buildings and bridges have been made by welding processes. New welding developments by the use of atomic hydrogen to prevent oxidation have been announced by the General Electric Company. Arc-welding manufacturers have found a ready market for the electric weld in railroad shops, in power stations and in industrial plants.

Motor developments continue to swing in the direction of ball and roller bearings, rolled or pressed steel frames, welding fabrication and a maximum use of across-the-line starting. The double-squirrel-cage motor has proved very popular, but comments have been heard that it has been used too freely. Time-delay low-voltage releases have been brought out this year that serve to hold motors on the lines when voltage dips occur. Industrial controllers and switches have been improved and made safer. Several new types have been developed for special applications and the remote and push-button controls have been adopted widely by industries.

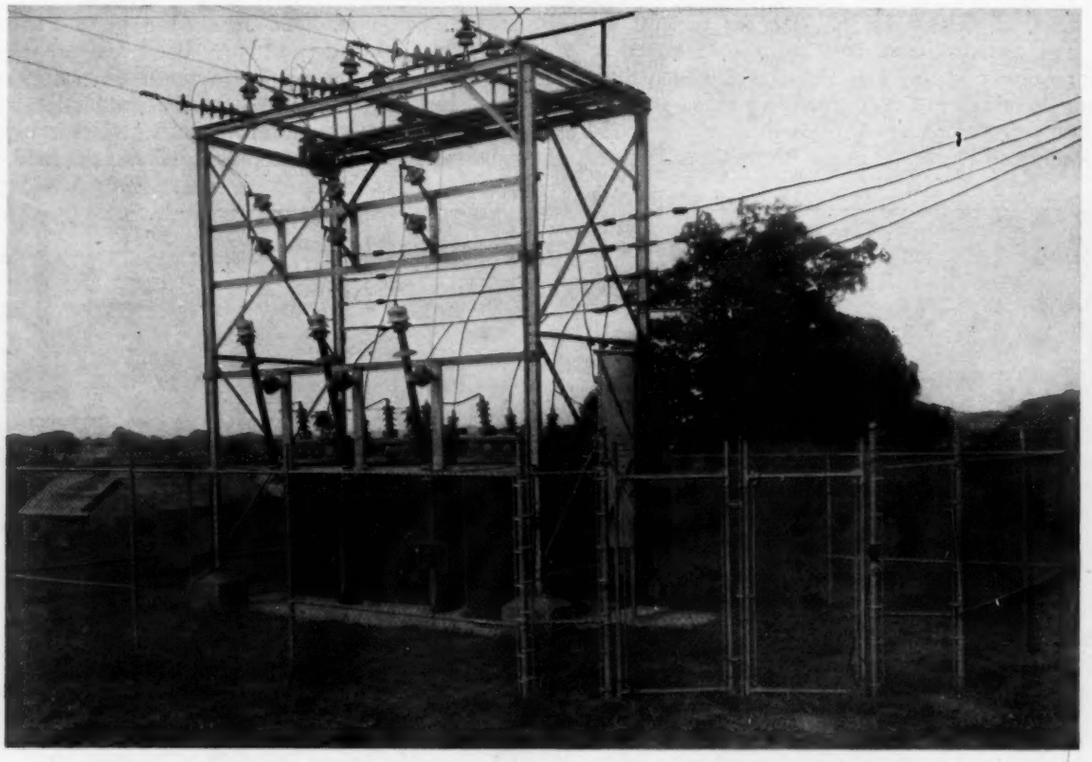
Electric heating applications have grown rapidly. The non-ferrous metal industries have adopted the electric furnace for melting and treating. In the automotive industry electric furnaces for steel treating and for japanning predominate. General industrial application for bread baking, glass making, ceramic baking and other heat applications have been developed and indicate great possibilities. The furnaces and ovens have been improved greatly and automatic controls and conveyors have been developed so as to give precise and continuous operation. Electric refrigeration, electric ranges, electric oil burners and electric water heaters are applications that have made great headway during 1927. In the apartment houses, in stores and in homes these devices have been sold in quantity and are developing into stable business activities. Manufacturers are studying the water heater problem closely and one company plans the construction of an external tank heater to be run at off-peak night power rates and perhaps at constant load on flat rates.

Miscellaneous Developments

Research work on dielectrics, lightning, oil breakers, radio and other major fields of activity has continued this year under more favorable conditions than before. Research facilities are better and there is a greater degree of co-operation among the workers.

Illumination advances have been great. The large searchlights and floodlights for airways, the great use of colored gas-filled lamps for signs, many new applications of ultra-violet lights and cathode rays and greater standardization in resistance filament lamps and fittings are some developments of major importance that have occurred during the year. Vacuum tubes and neon tubes have been used in new instruments to measure small electrical and illumination values accurately. There have also been developments of various applications using vacuum tubes, such as synchronizing equipment, carrier-current pilot protective system, cable coupling capacitor, street light control, high-voltage voltmeter, etc.

Railroad electrification has become active during the year. The Chicago terminal electrification and further electrification of the Chicago, Milwaukee & St. Paul have been two major jobs, and reports are current that major electrifications are planned for the Pennsylvania and Reading railroads in the near future.

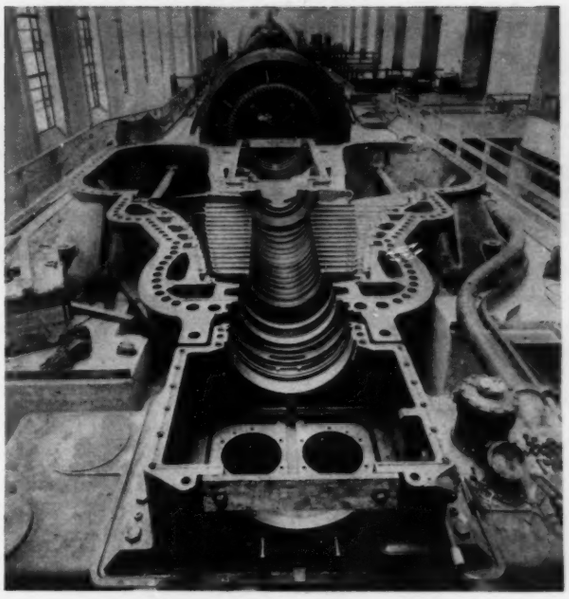


PUBLIC RELATIONS, COST AND ERECTION TIME HAVE INFLUENCED THE USE OF GOOD-LOOKING STANDARDIZED SUBSTATIONS (DELTA-STAR)

Typical New Apparatus of the Year

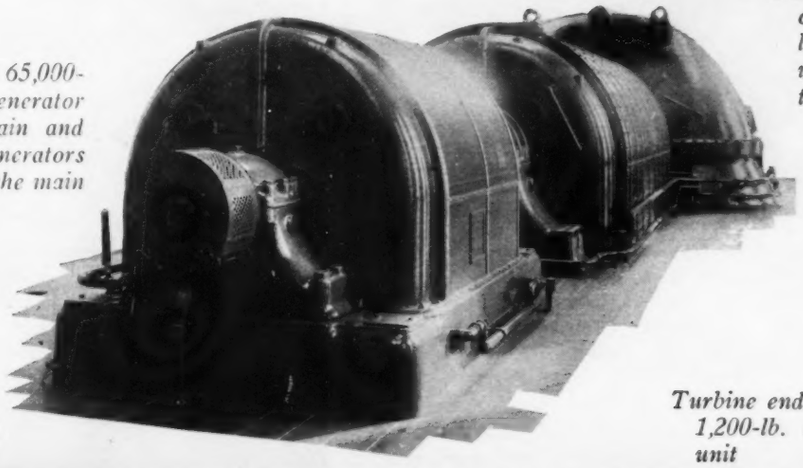
A PICTORIAL presentation of typical 1927 outstanding developments, the photographs of which speak for themselves, is offered in this section. Although they do not embrace every new development, they represent a diversified line of equipment reported by various manufacturers as now on the market. A summary of all new equipment reported by the manufacturers appears elsewhere in this issue.

Advanced practice in steam-turbine development in the Edgar station is shown in the illustrations on this page. The 65,000-kw. turbine operates with a steam temperature of 725 deg. F. at the throttle. The turbine will be bled at the ninth, eleventh and fifteenth stages for heating the feed water.

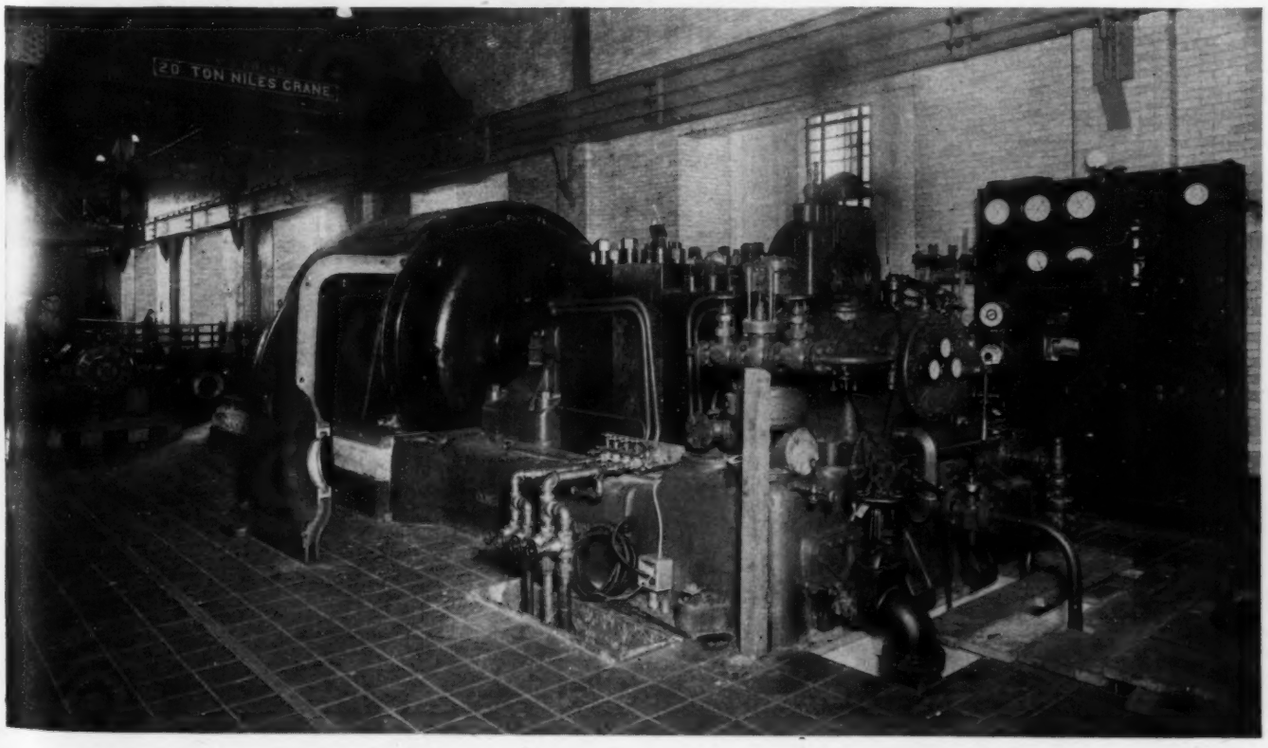


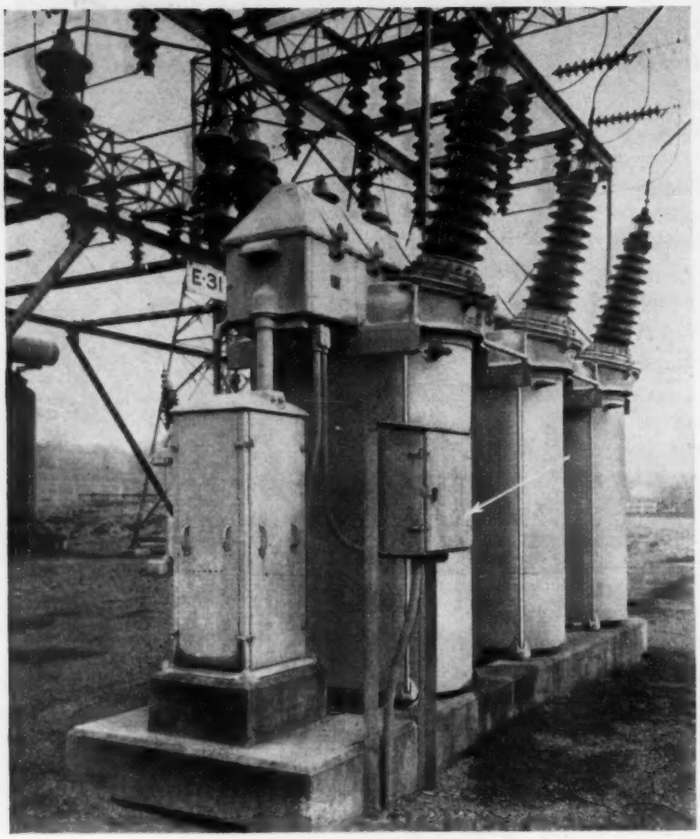
View during erection of 65,000-kw., 350-lb. turbo-generator unit (General Electric Company)

Generator end of 65,000-kw., turbo-generator unit. The main and auxiliary generators are driven by the main turbine.



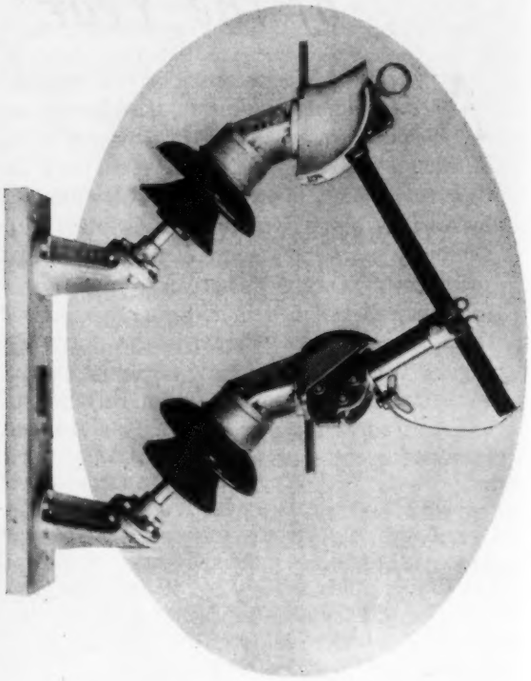
Turbine end of 10,000-kw., 1,200-lb. turbo-generator unit



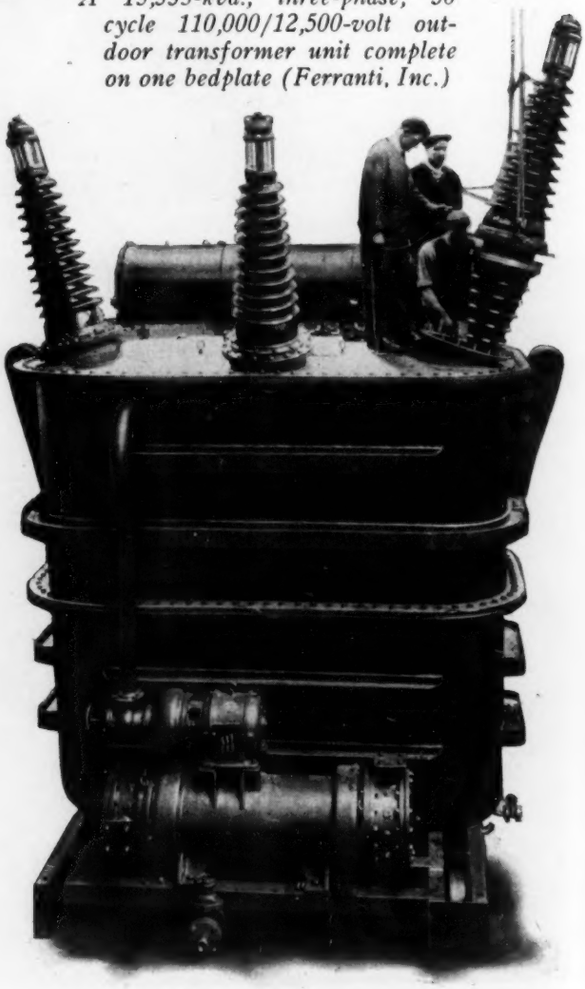


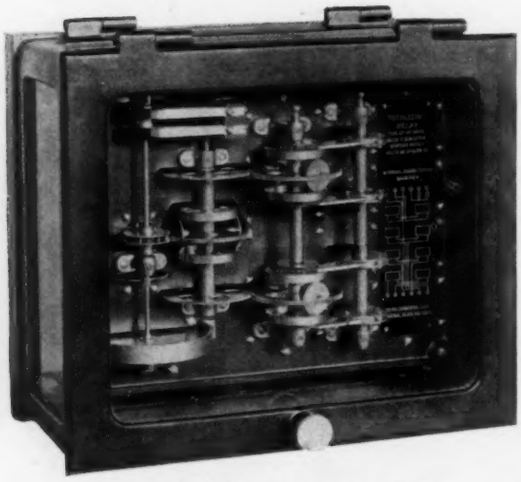
Vacuum-tube synchroscope installation in an outdoor substation of the Adirondack Power & Light Company (General Electric Company)

Combination disconnect and fuse for circuits up to 40,000 volts, 175 amp. (Hi-Voltage Equipment Company)

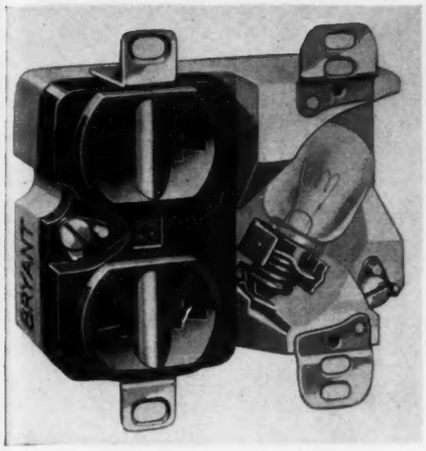


A 13,333-kva., three-phase, 50 cycle 110,000/12,500-volt outdoor transformer unit complete on one bedplate (Ferranti, Inc.)

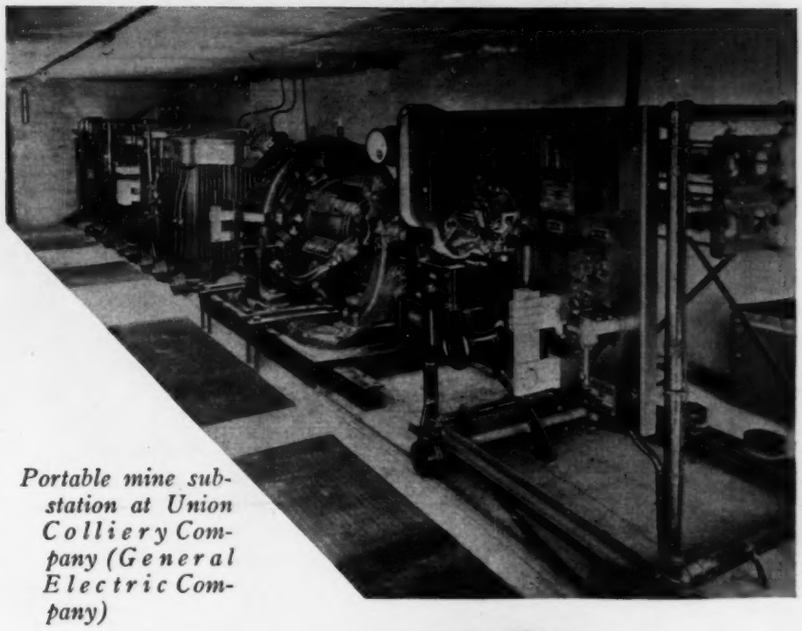




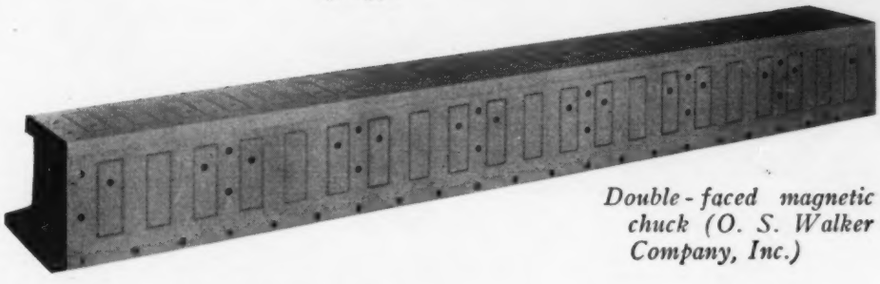
Totalizing demand relay (General Electric Company)



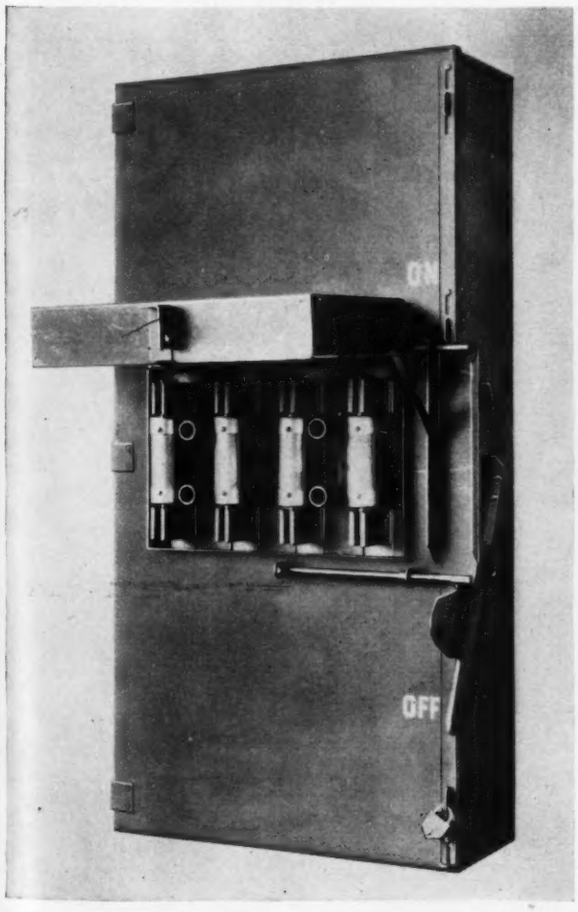
Cupped boss receptacle with locating rib or slot finder (Bryant Electric Company)



Portable mine substation at Union Colliery Company (General Electric Company)



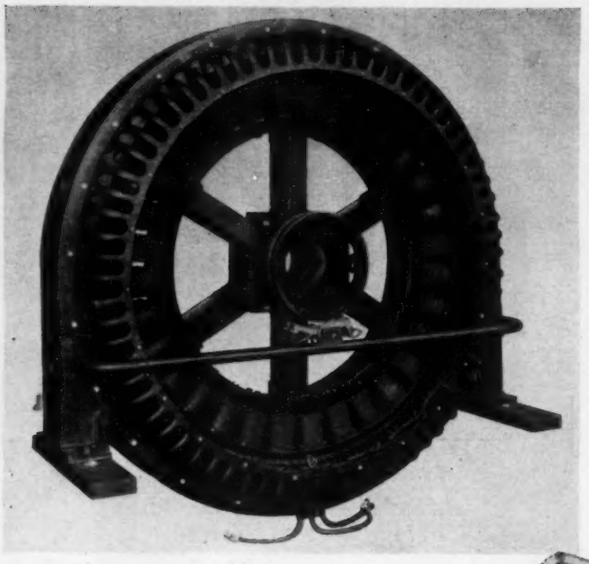
Double-faced magnetic chuck (O. S. Walker Company, Inc.)



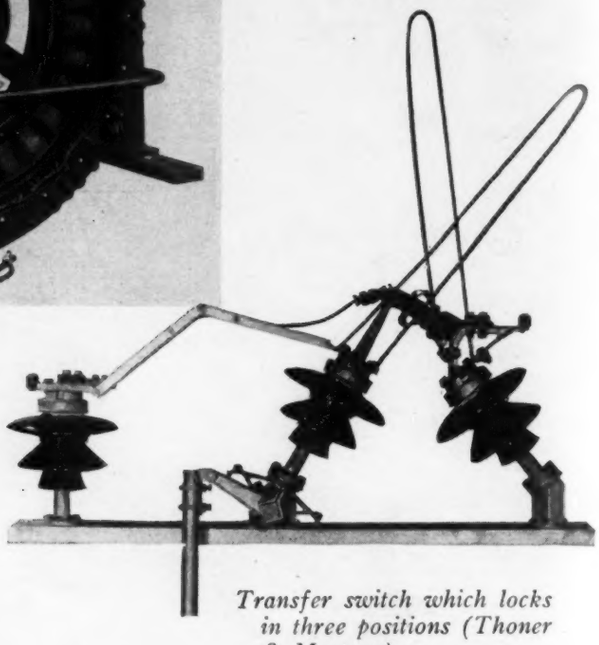
Accessible quick make-and-break dead-fuse safety switch up to 600 amp., 250 volts (Palmer Electric & Manufacturing Company)

Cast-iron box with adjustable-speed traffic-signal timer (General Electric Company)

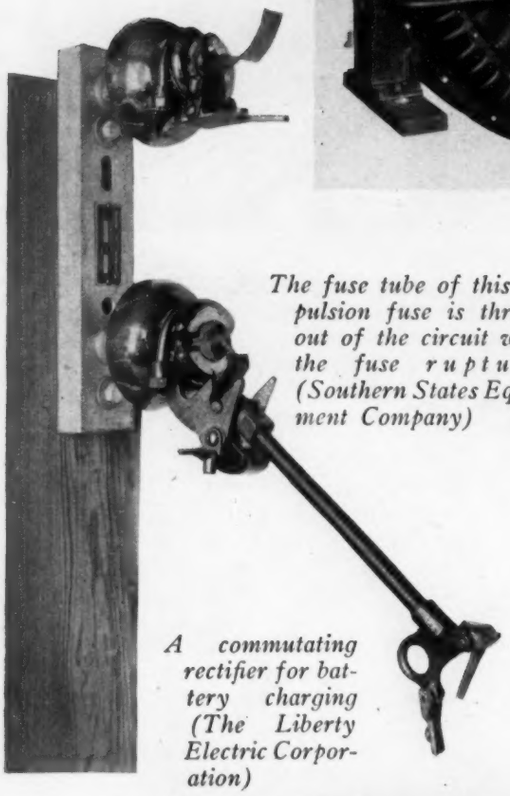
Low-speed arc-welded synchronous motor (Westinghouse Electric & Manufacturing Company)



Pole-top switch with pyramid-type contact (Royal Electric Manufacturing Company)

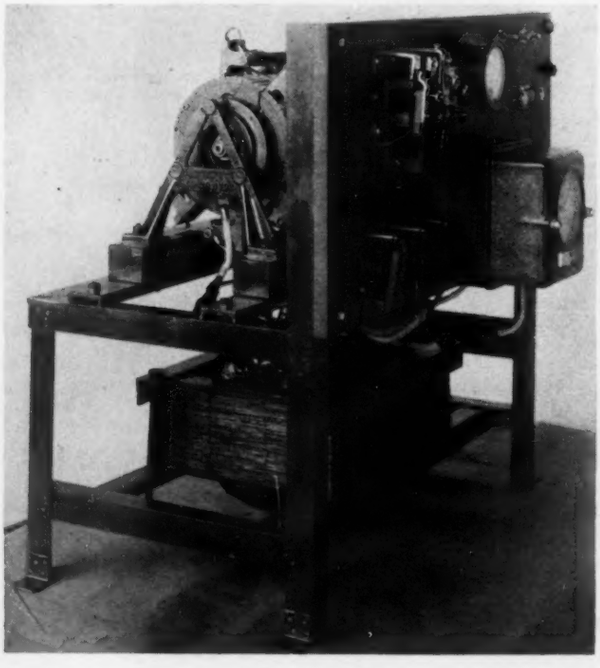


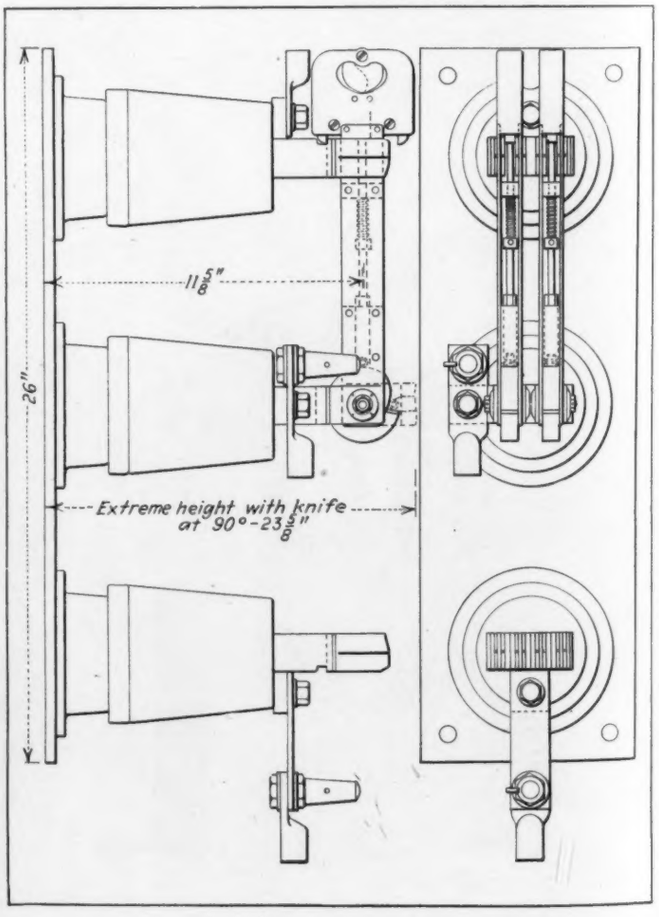
The fuse tube of this expulsion fuse is thrown out of the circuit when the fuse ruptures (Southern States Equipment Company)

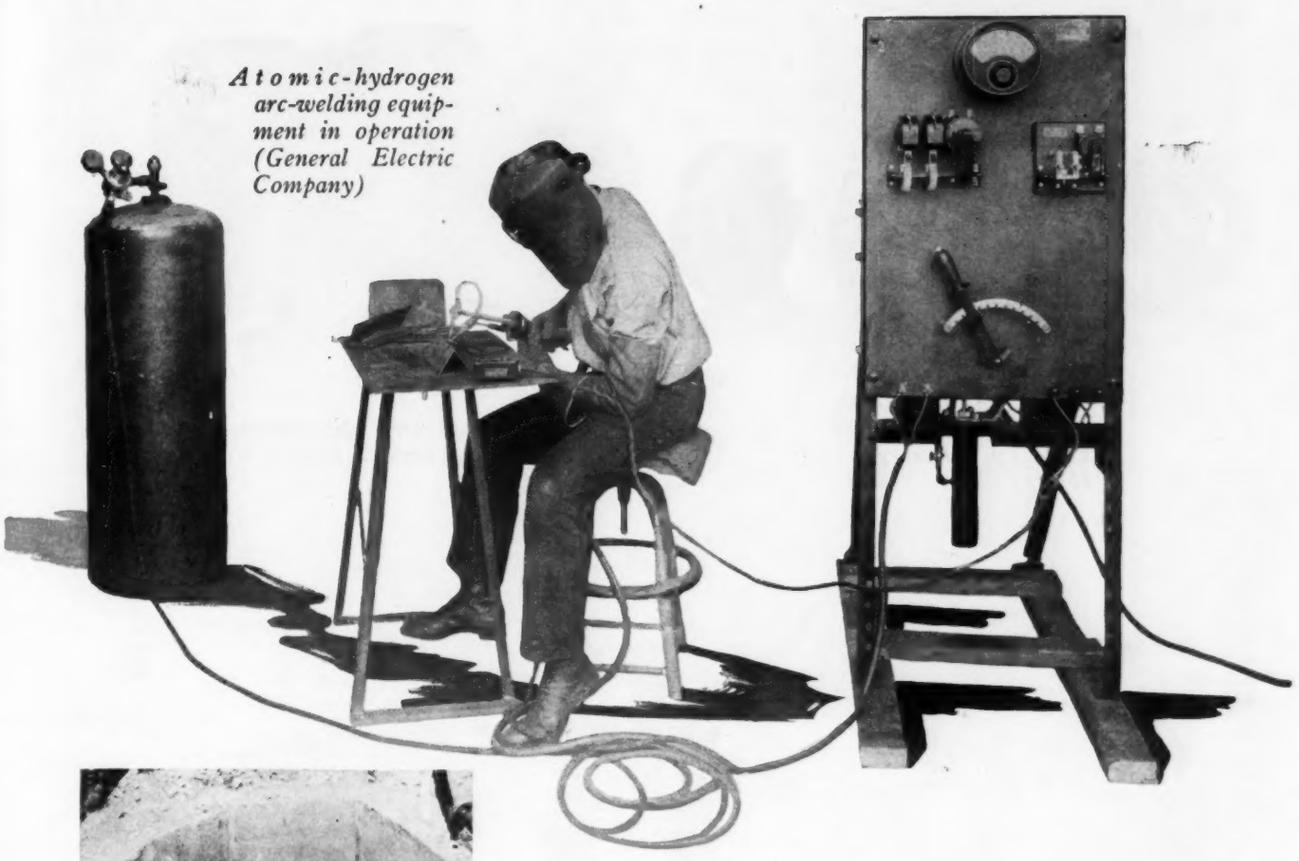


Transfer switch which locks in three positions (Thoner & Martens)

A commutating rectifier for battery charging (The Liberty Electric Corporation)



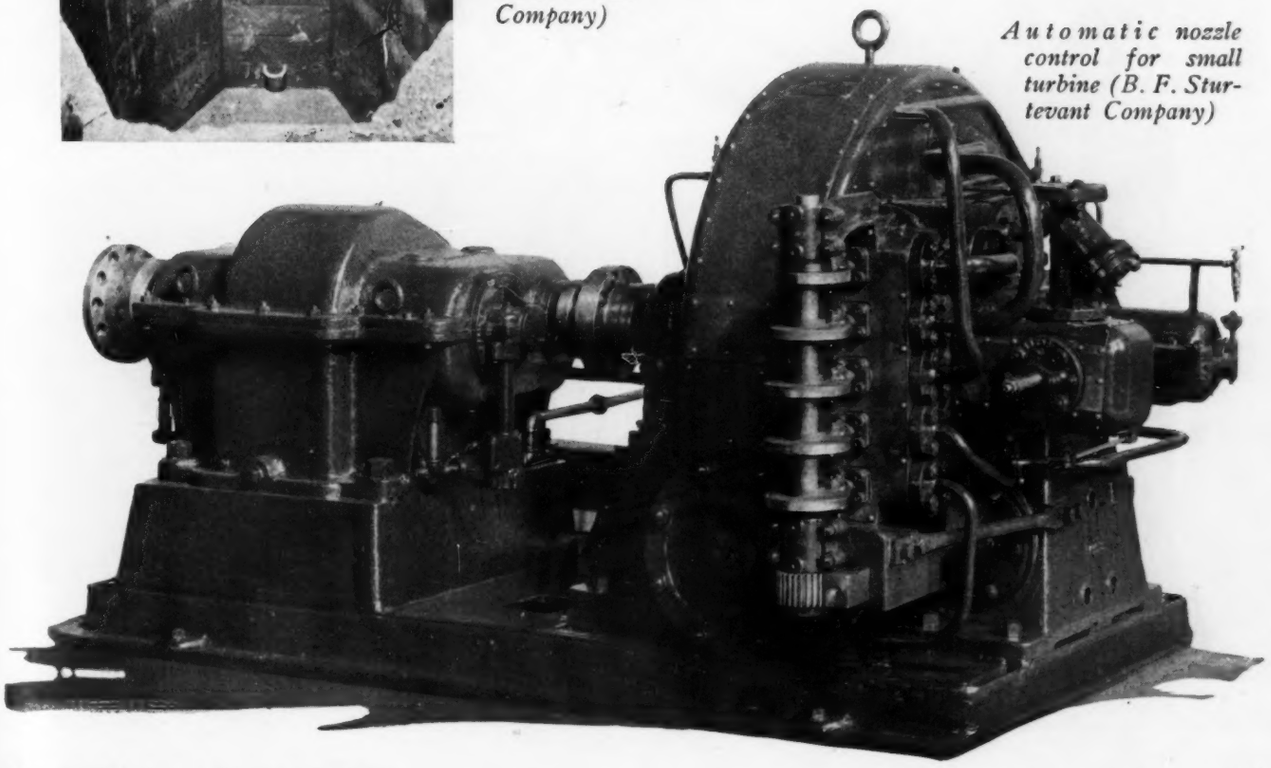


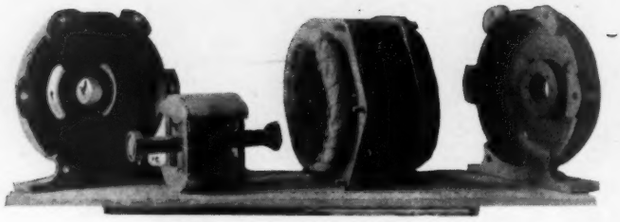


Atomic-hydrogen arc-welding equipment in operation (General Electric Company)

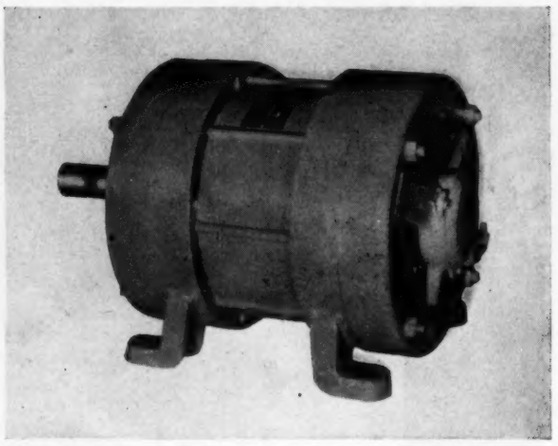
Porcelain duct entrances for underground cable installations (Line Material Company)

Automatic nozzle control for small turbine (B. F. Sturtevant Company)



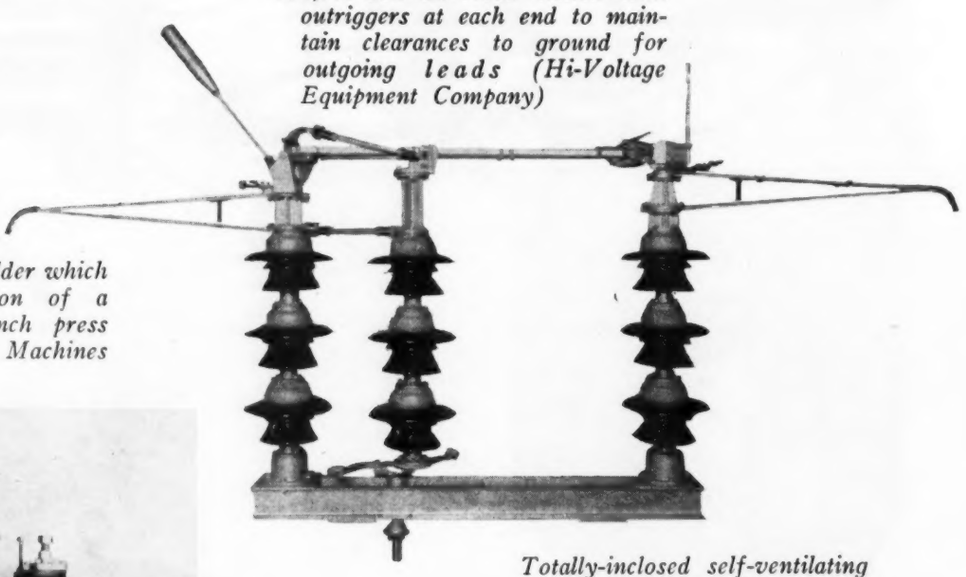


Unit to change 60 cycles to 180 cycles for high-speed induction-motor supply (Forbes & Myers)

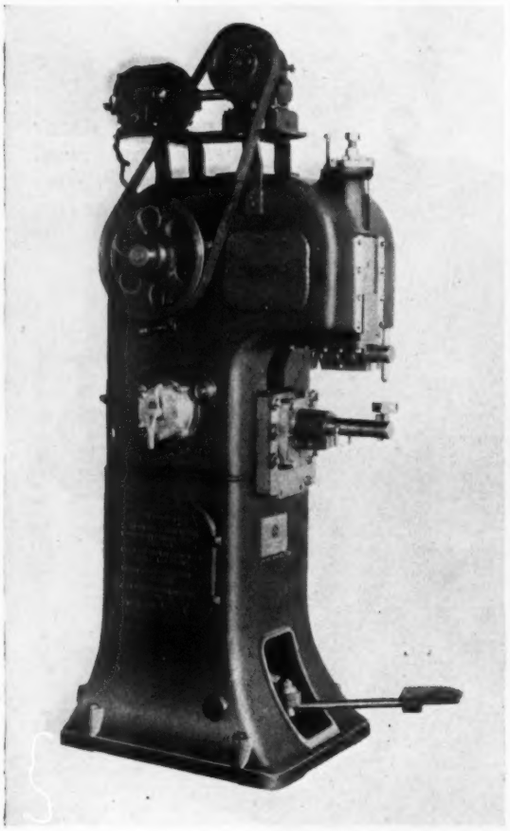


Polyphase, all-steel, ball-bearing motors up to 100 hp. (Lincoln Electric Company)

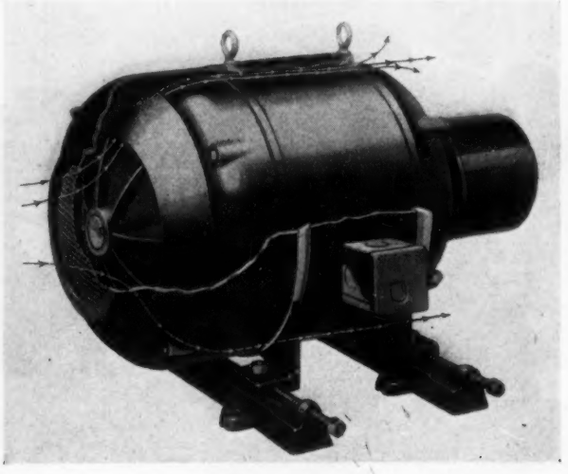
132,000-volt air-break switch with outriggers at each end to maintain clearances to ground for outgoing leads (Hi-Voltage Equipment Company)



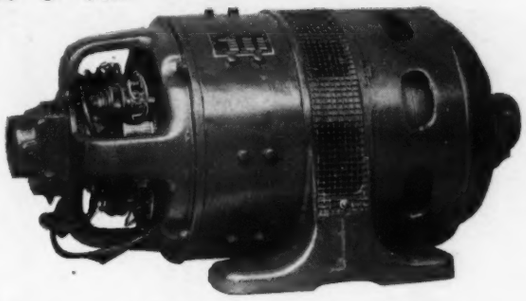
Automatic spot welder which is a combination of a welder and punch press (Gibb Welding Machines Company)



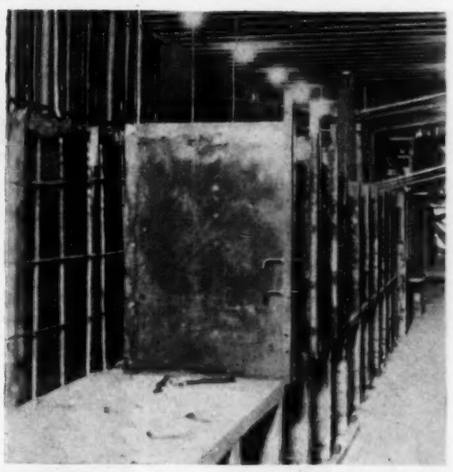
Totally-inclosed self-ventilating motor with self-adjusting roller bearings (Howell Electric Motors Company)



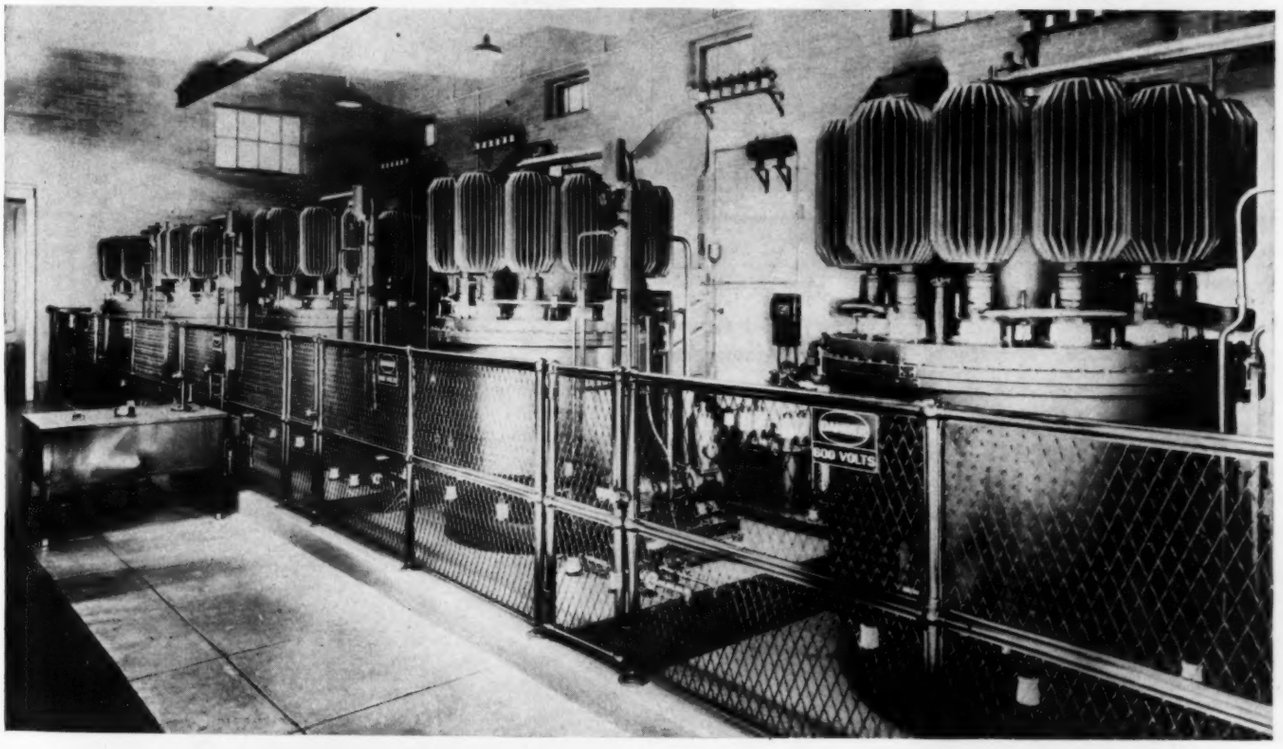
A two-bearing motor-generator set (Roth Brothers & Company)

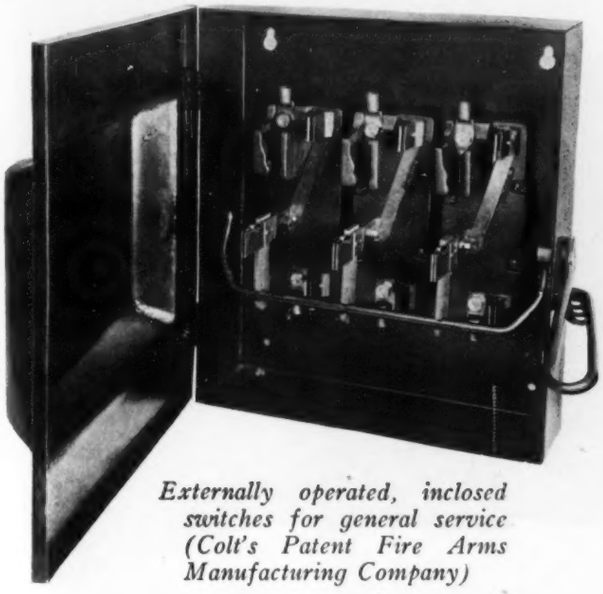


Unit steel forms for concrete bus cell construction (Bus Structure Company)

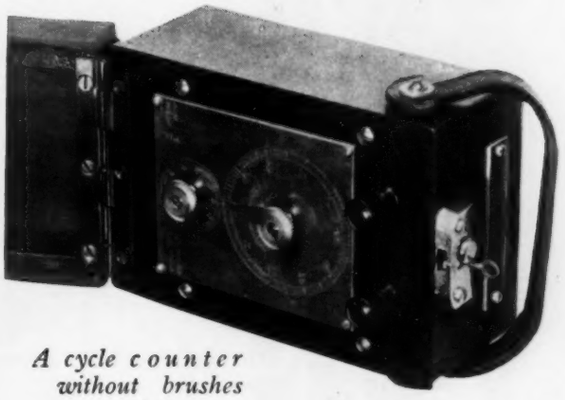


A 6,000-kw. mercury-arc rectifier substation of Connecticut Company at Bridgeport. The units are rated at 1,200 kw., 600 volts, 1,200 amp. (American Brown Boveri Electric Corporation)

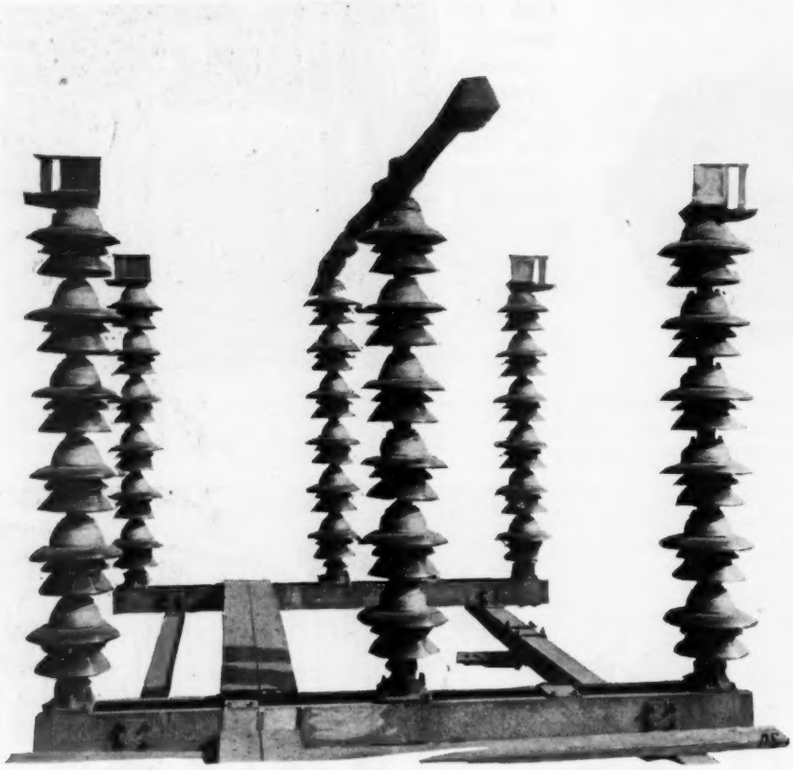




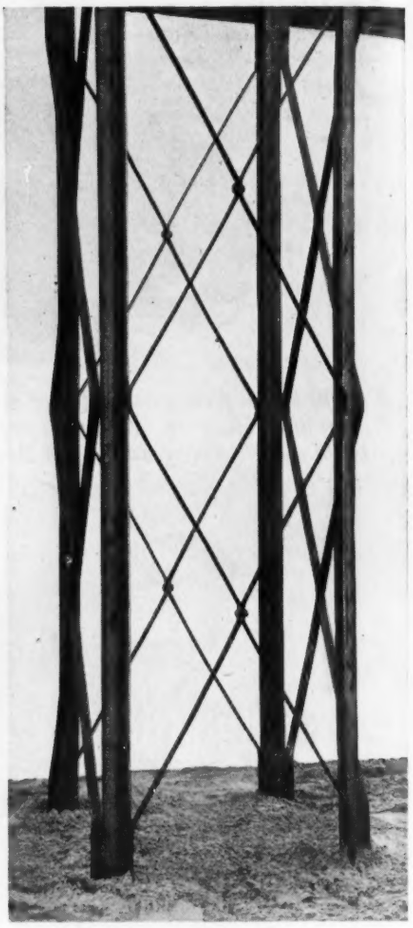
Externally operated, inclosed switches for general service (Colt's Patent Fire Arms Manufacturing Company)



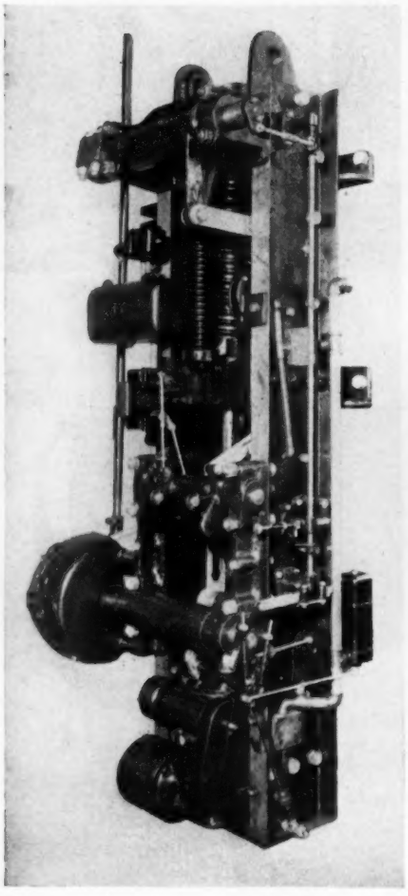
A cycle counter without brushes or revolving armature (The States Company)



220-kv. switch in which the blades first rise from the contacts and then turn horizontally (Delta-Star Electric Company)

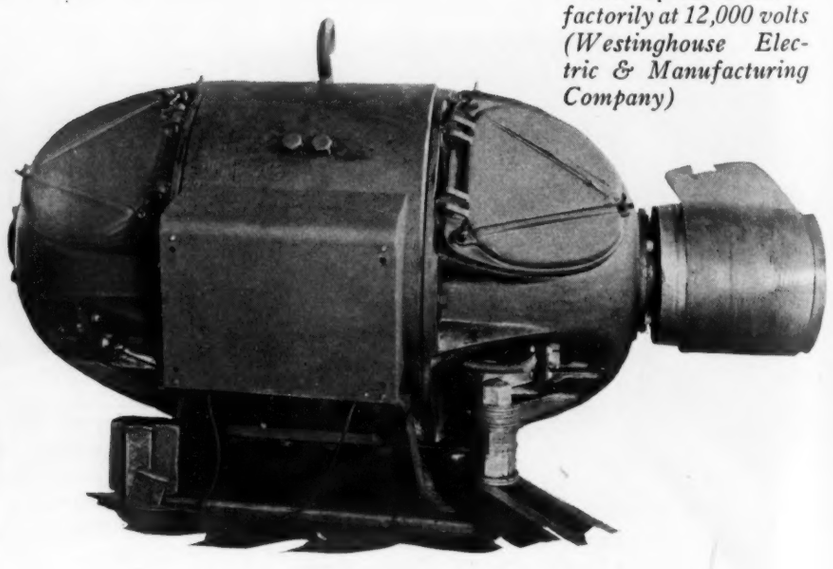


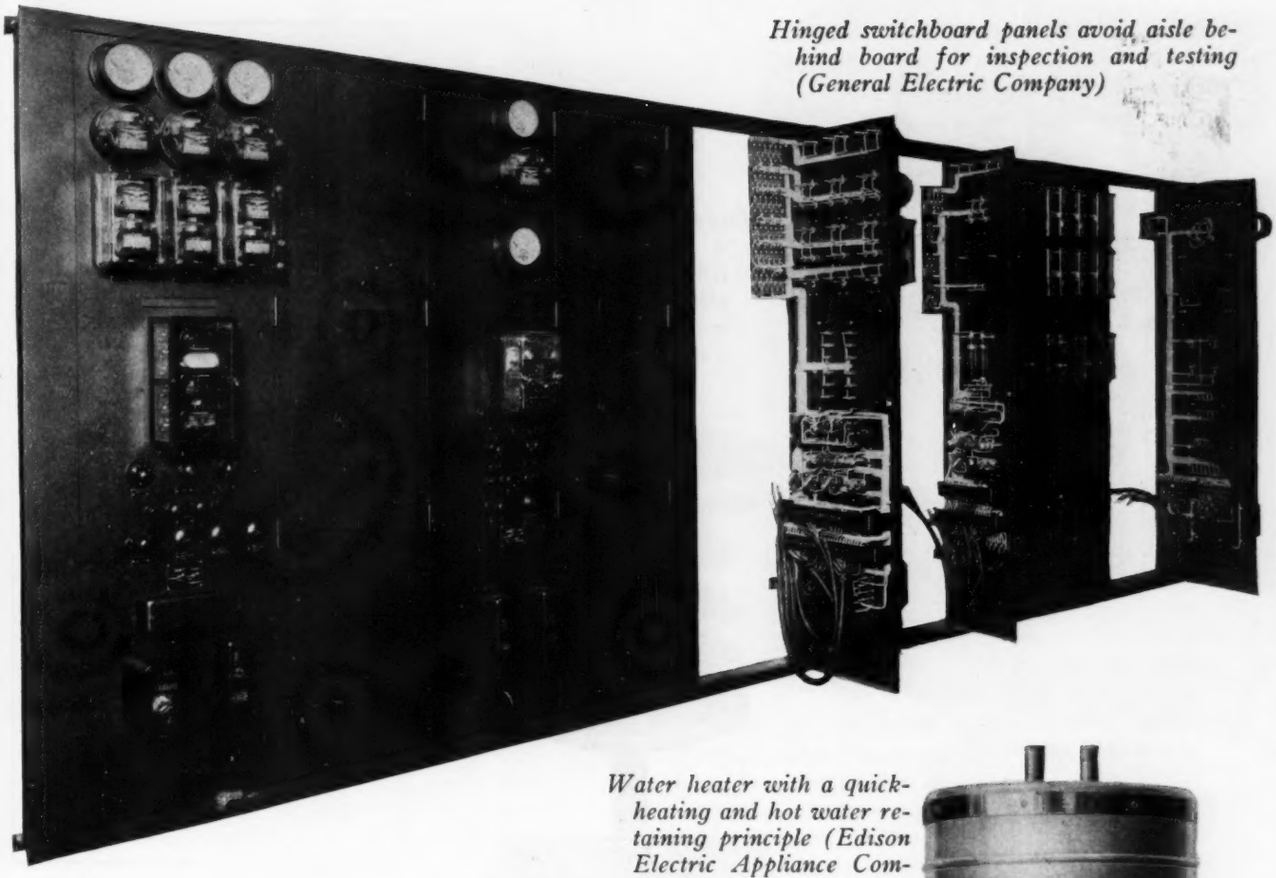
Mast designed to fill the gap between poles and towers (Walter Bates Steel Corporation)



Motor mechanism for use in large vertical isolated-phase power stations (General Electric Company)

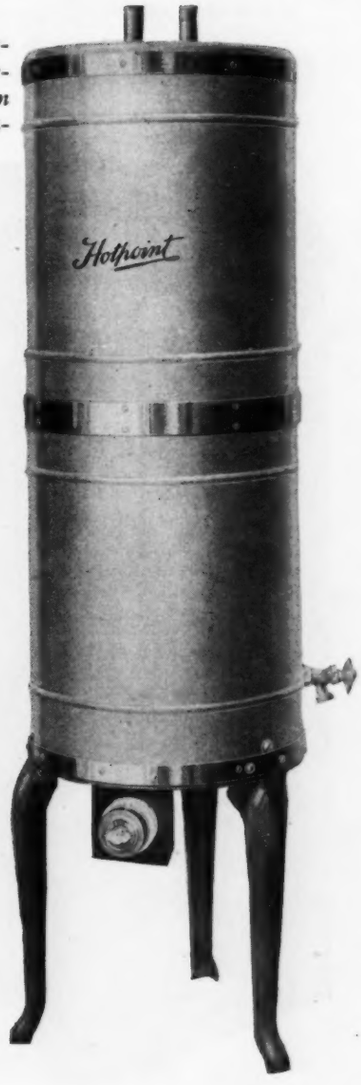
25-kw., 7,500-volt direct-current generator which operated satisfactorily at 12,000 volts (Westinghouse Electric & Manufacturing Company)

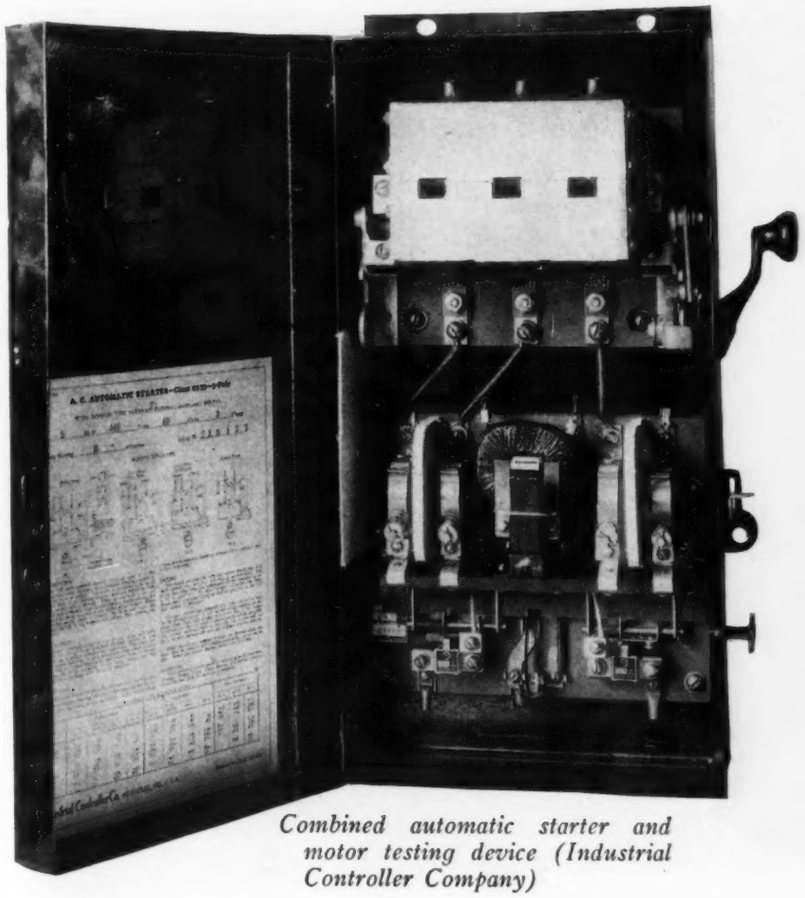




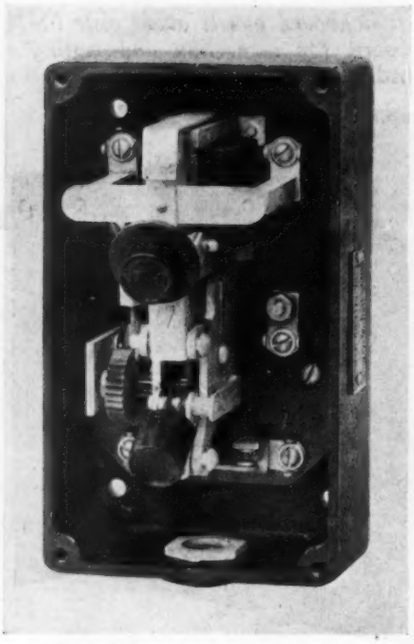
Hinged switchboard panels avoid aisle behind board for inspection and testing (General Electric Company)

Water heater with a quick-heating and hot water retaining principle (Edison Electric Appliance Company)



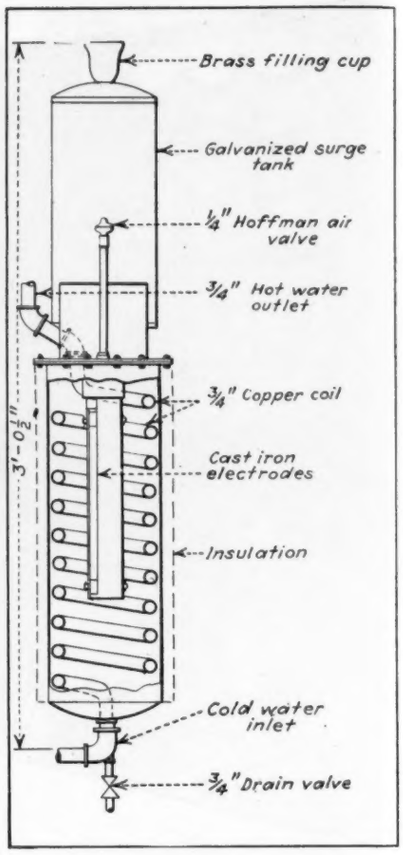


Combined automatic starter and motor testing device (Industrial Controller Company)

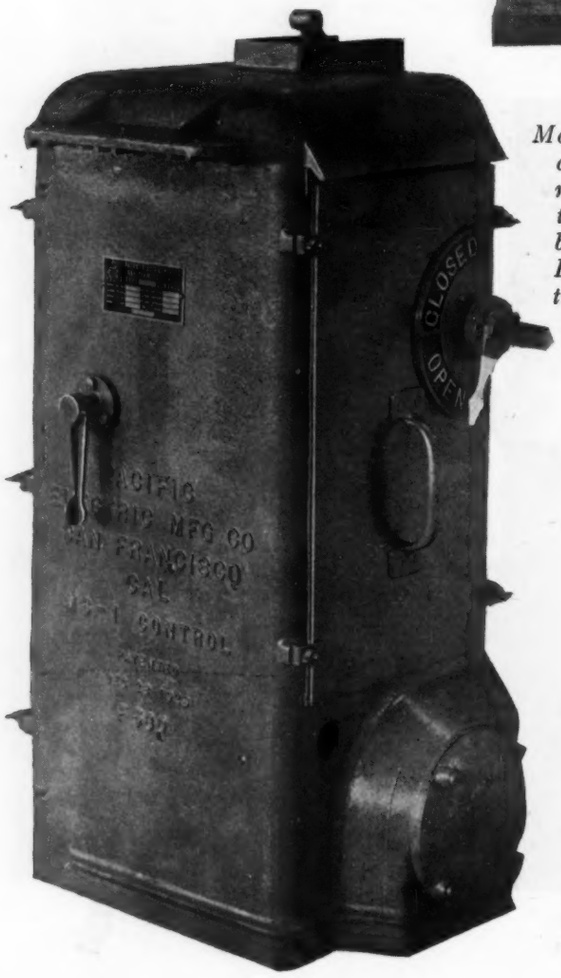


Time-delay push-button station for use with magnetic starter (General Electric Company)

Fog-type insulator with a practically uniform leakage path. Suspension type units are also made (Lapp Insulator Company)

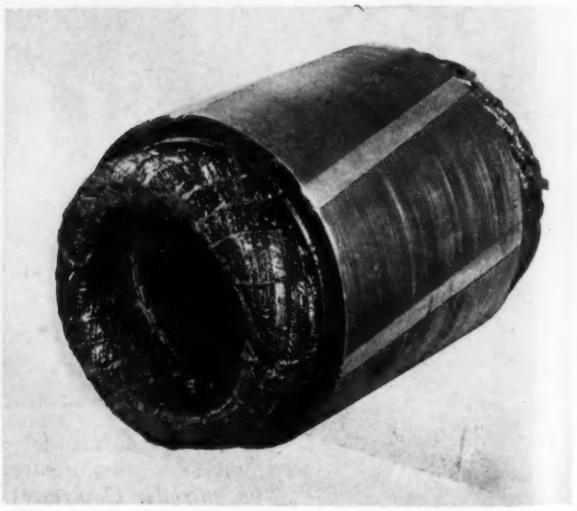


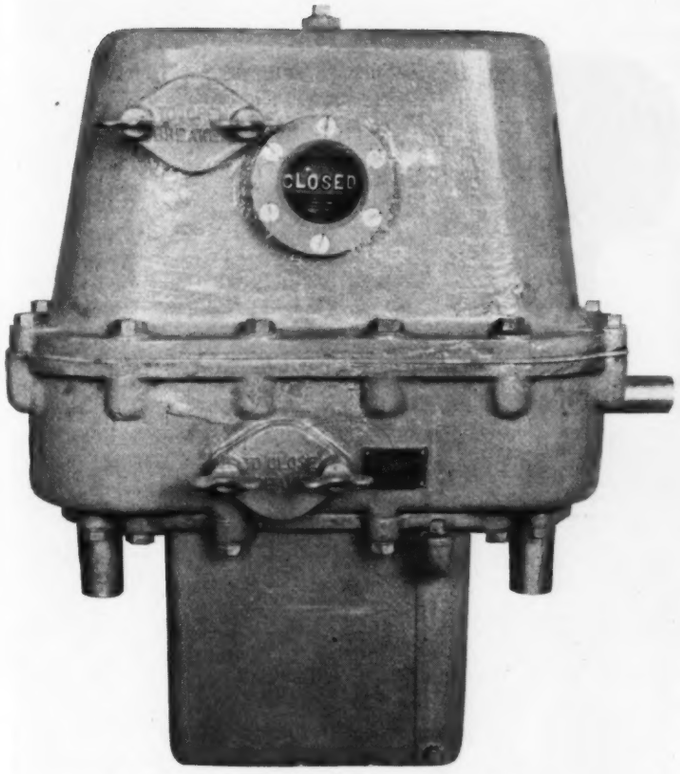
Water being heated serves as resistance medium (Chicago Automatic Electric Boiler Company)



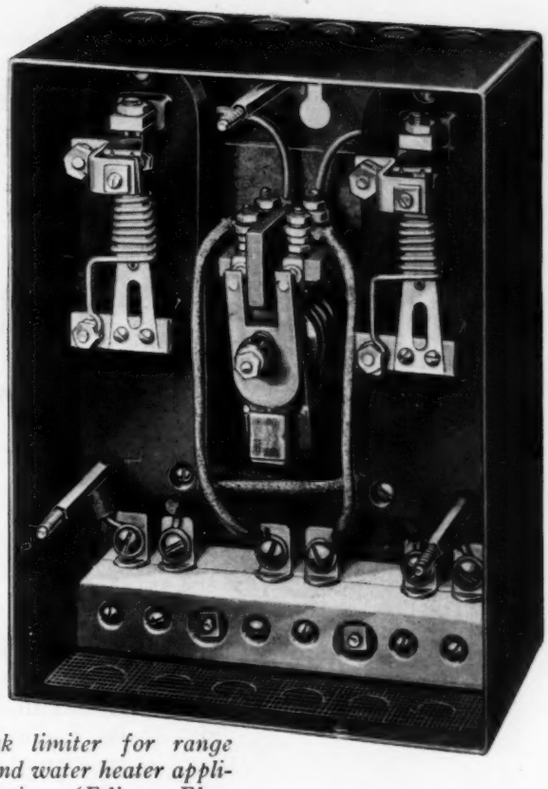
Motor-wound spring-operated control mechanism for vertical plunger-type breakers (Pacific Electric Manufacturing Company)

Stator of 5-hp. shell-type motor, an all-welded design (Lincoln Electric Company)

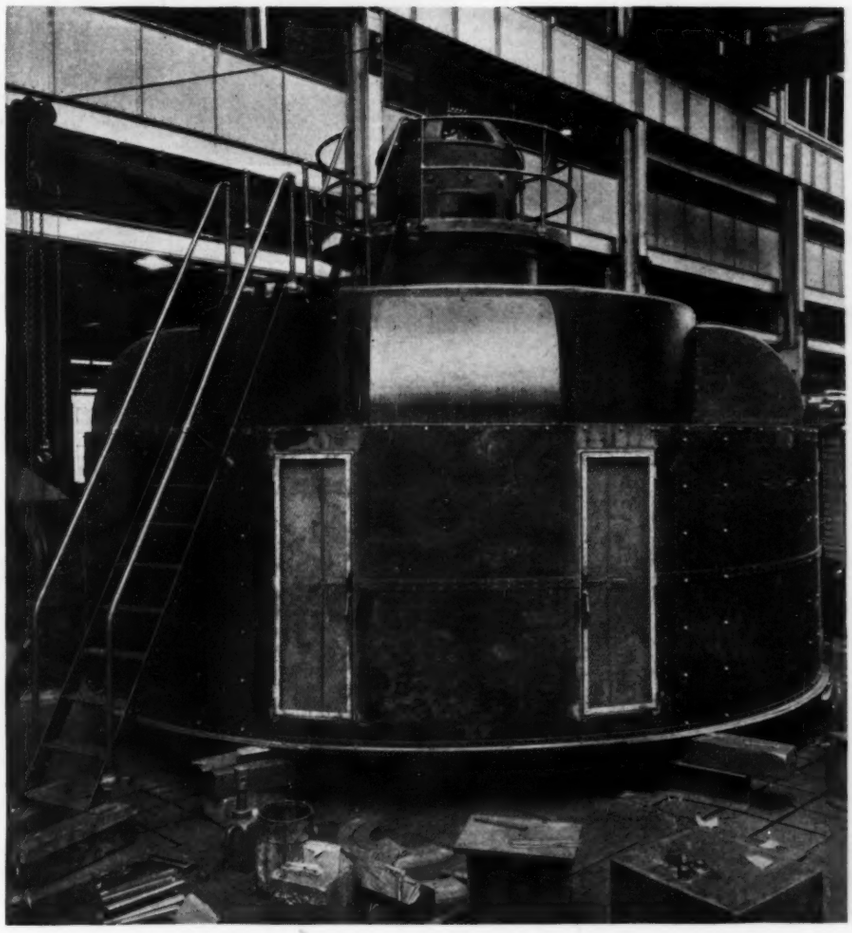




Subway oil circuit breaker for remote control 4,500 volts 200-400 amp. (Westinghouse Electric & Manufacturing Company)



Peak limiter for range and water heater application (Edison Electric Appliance Company)

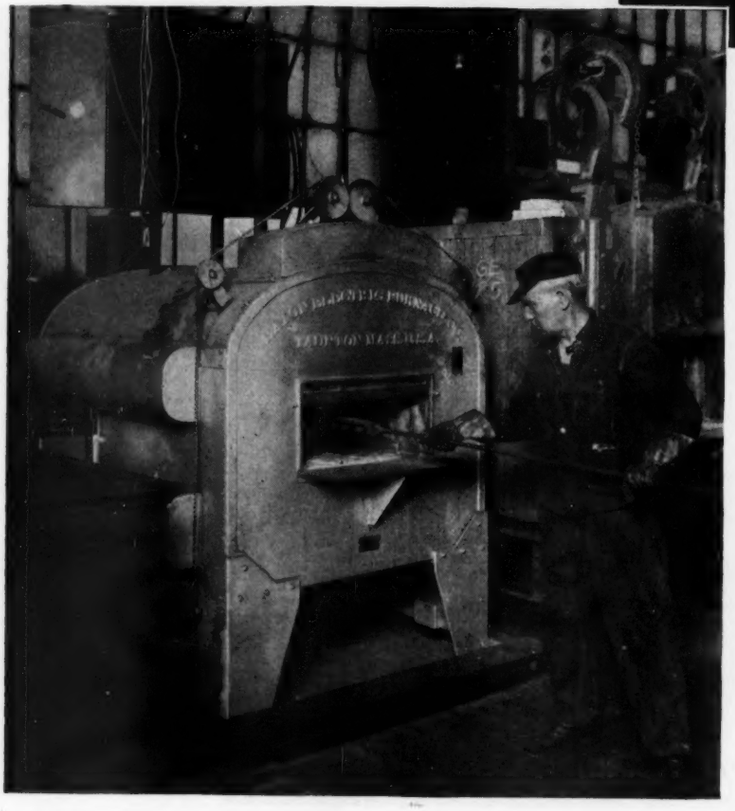


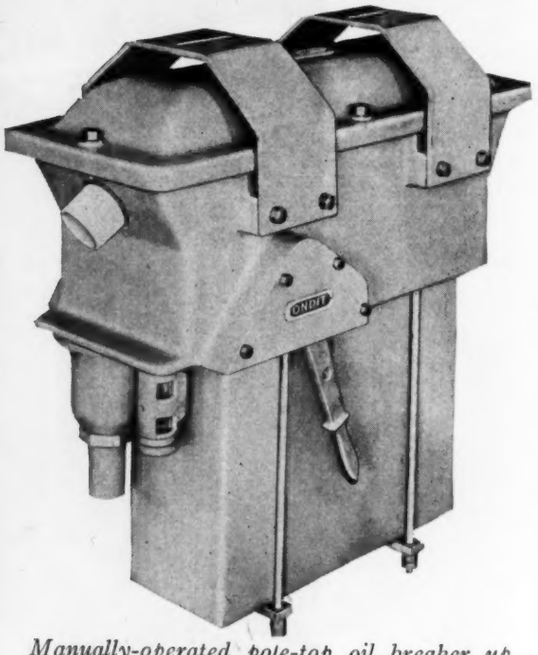
Surface air coolers are in duct surrounding the frame (General Electric Company)

Split-core current measuring set (General Electric Company)

Receiver apparatus in the beam-radio station of the Radio Corporation at Riverhead, Long Island

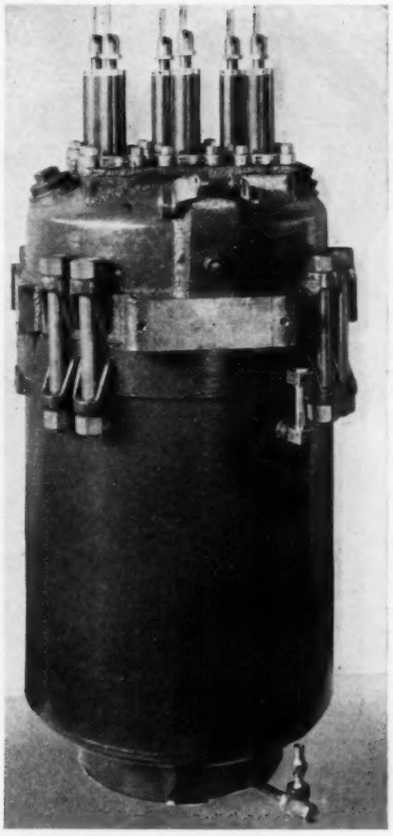
A 2,400-deg. F. silicon-carbide cold-end heating unit electric furnace for steel treating and refractory testing (Sentry Company)



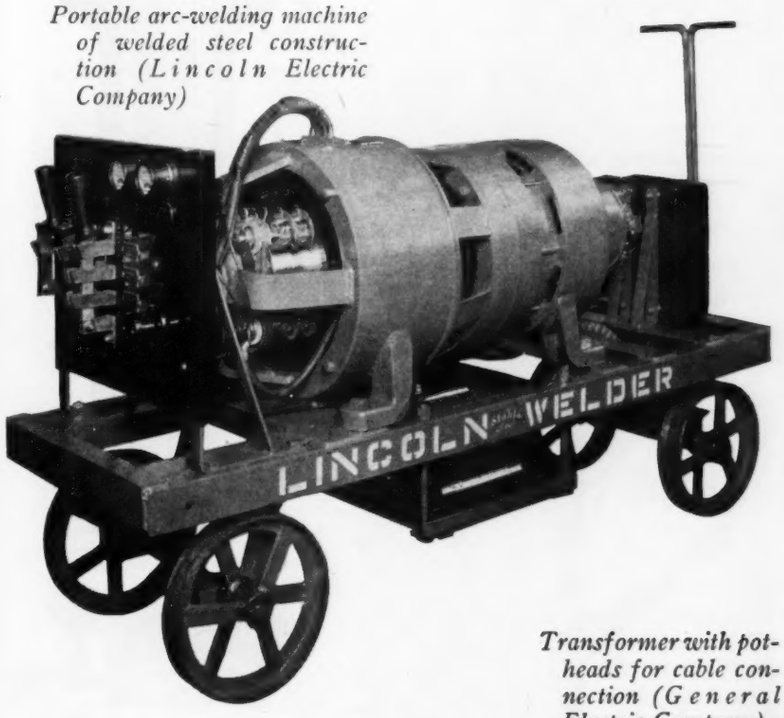


Manually-operated pole-top oil breaker up to 7,500-volt service (Condit Electrical Manufacturing Corporation)

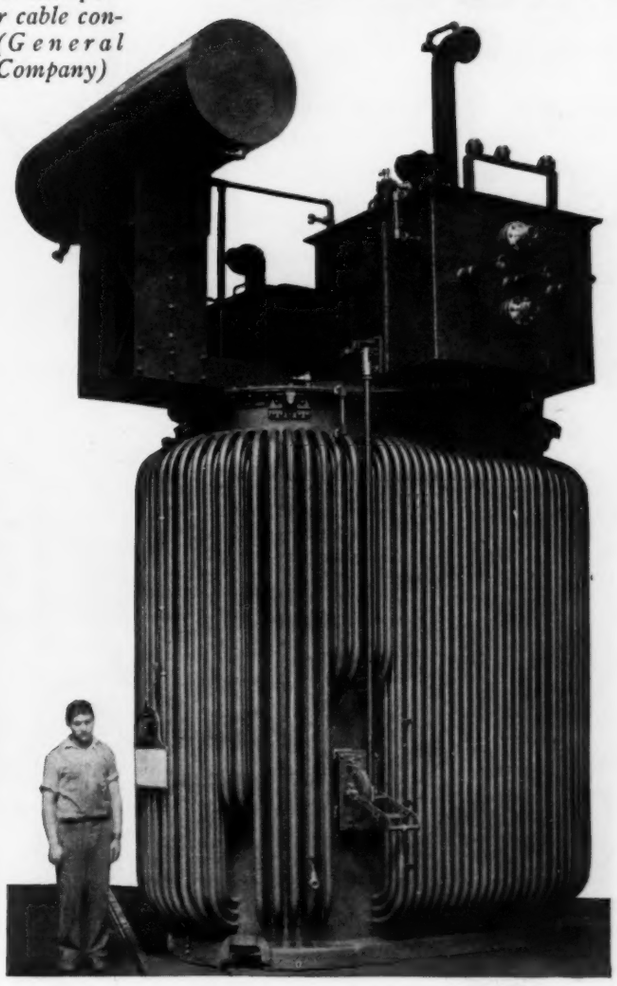
Feeder breaker of moderately high interrupting capacity (General Electric Company)

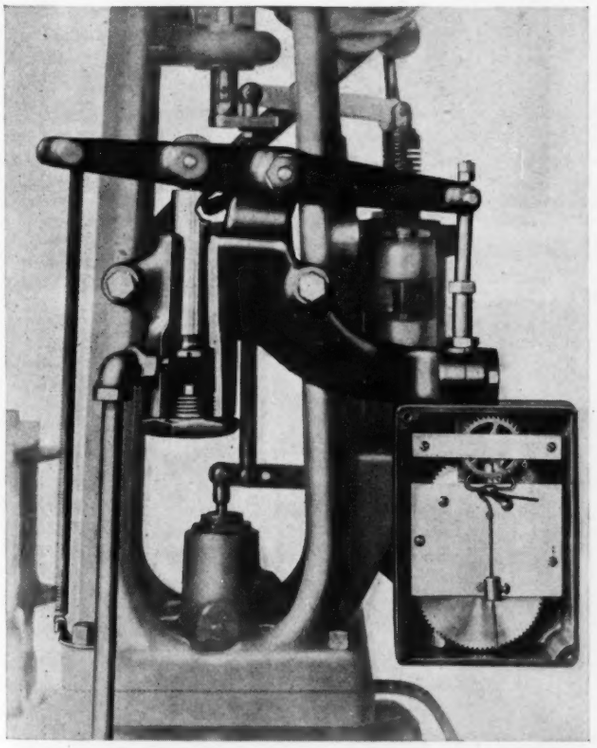


Portable arc-welding machine of welded steel construction (Lincoln Electric Company)

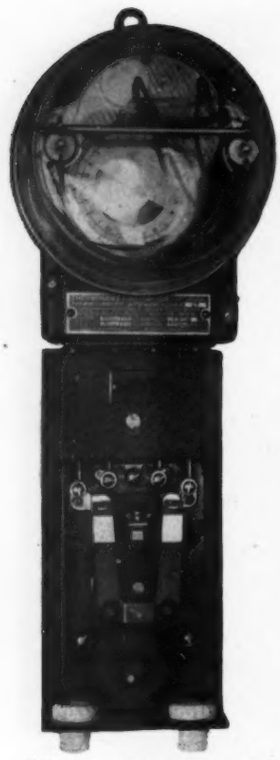


Transformer with pot-heads for cable connection (General Electric Company)



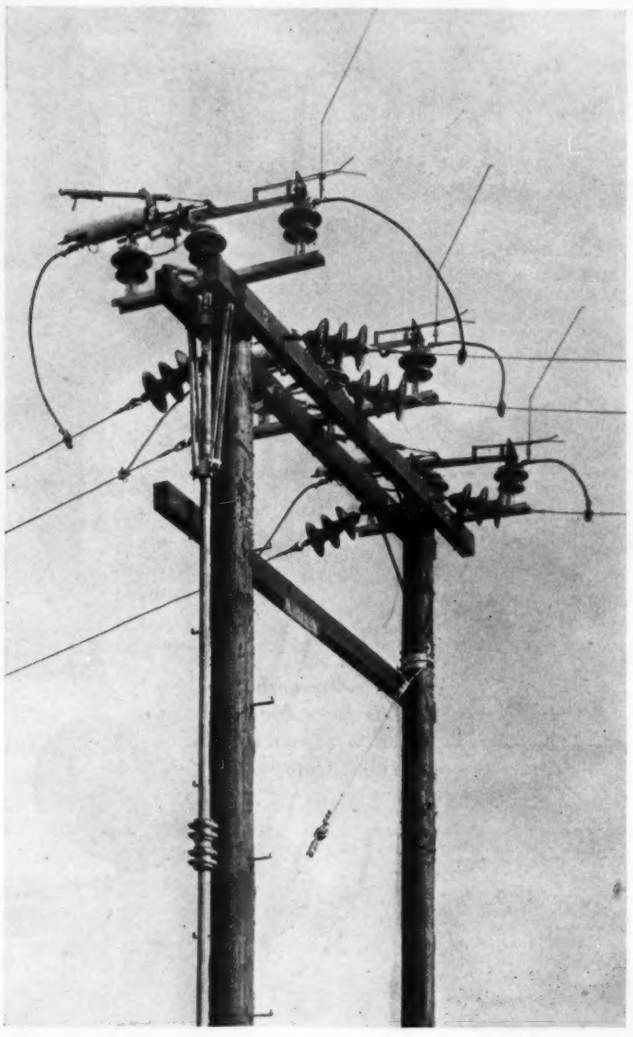


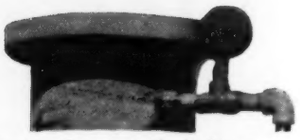
Mechanical timer for automatic operation of waterwheel governors (Woodward Governor Company)



Time switch with electrically-wound clock for use with water heater (Thermogray Company)

Series solenoid overload trip-free gang-operated switch (Johnson Manufacturing Company)

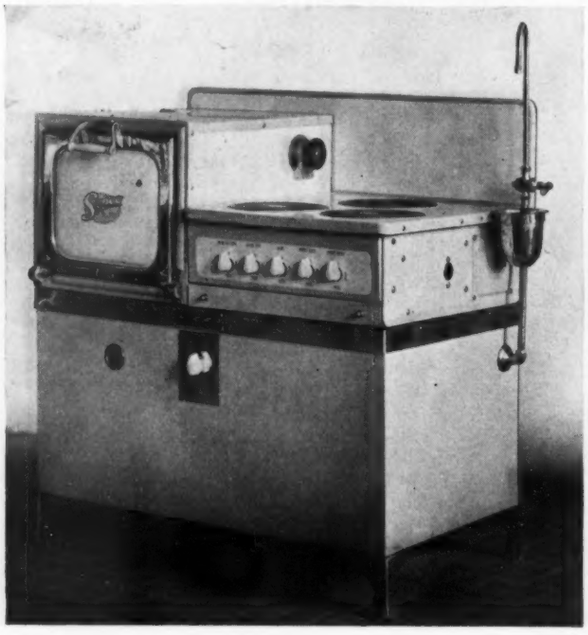


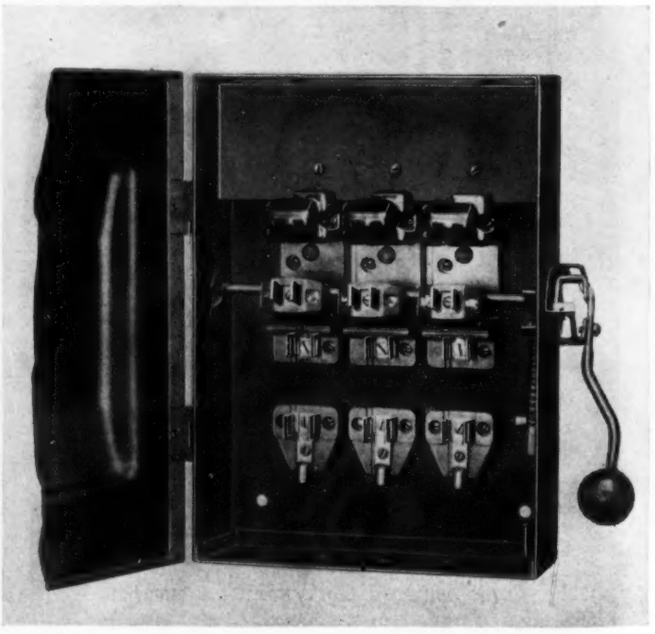


Inner element of oil filter using the principle of edge filtration (S. F. Bowser & Company, Inc.)

Combined electric range and water heater cabinet (Automatic Electric Heater Company)

Air circuit breaker (Trumbull-Vanderpoel Electric Company)





Summary of

Equipment Developments in 1927

ACCOMPLISHMENTS reported by manufacturers during 1927 covering new products developed and equipment on which major developments were made are here presented in alphabetical order according to the manufacturer. A sufficient description of each item is given to enable the reader to seek further detailed information regarding any product. Many of the items here listed were previously described, and in some cases illustrated, in various issues of the ELECTRICAL WORLD throughout the year as soon as they were announced by the manufacturer. Elsewhere in this issue are fourteen pages of illustrations indicating typical outstanding developments which are evident in a pictorial presentation.

ADAPTI COMPANY, CLEVELAND

Threaded composition bushings with or without locknuts
Bar hanger fixture stud
Stamped steel outlet box for reinforced concrete
Line of rigid conduit fittings
Fixture elbows adapted for sign manufacturers

ALLEN-BRADLEY COMPANY, MILWAUKEE

Push-button control across-the-line starting switch for motors up to 1½ hp.
Line of alternating and direct-current push-button starters up to 15 hp., 550 volts.

ALLIS-CHALMERS MANUFACTURING COMPANY, MILWAUKEE

Armorclad switchgear.

LOUIS ALLIS COMPANY, MILWAUKEE

Self-contained fully inclosed ventilated motor

AMERICAN BLOWER COMPANY, DETROIT

"Sirocco" dust collector
Slow-speed exhaust fan wheel
"Ventura" disk ventilating fan with square frame

AMERICAN BRASS COMPANY, NEW YORK

Anaconda "Hitenso BB"—a high-conductivity high-strength wire for long spans

AMERICAN ENGINEERING COMPANY, PHILADELPHIA

"Lo-Hed" electric hoists
"Quick-Lift" all-steel quarter-ton high-speed electric hoist

AMERICAN METALLURGICAL CORPORATION, BOSTON

Forty-kilowatt rapid steel-treating furnace of the oil-heater type
Cyanide pot-type furnace for treating set-screws and capscrews

AMERICAN WELL WORKS, AURORA, ILL.

Non-plugging centrifugal pump

ALBERT & J. M. ANDERSON MANUFACTURING COMPANY, BOSTON

Automatic motor-driven time switch with season-changing device

ARROW ELECTRIC COMPANY, HARTFORD, CONN.

Interchangeable porcelain fittings
Composition socket bodies and caps
Heavy-duty flush switch
Three-wire polarized devices

AUTOMATIC ELECTRIC HEATER COMPANY, PHILADELPHIA

"Sepco" cabinet-type storage water heater
"Sepco" sun-electric water heater

AUTOMATIC SWITCH COMPANY, DETROIT

Type T automatic reclosing equipment

BABCOCK & WILCOX COMPANY, NEW YORK CITY

Return bend wrought-steel economizer

BACHARACH INDUSTRIAL INSTRUMENT COMPANY, PITTSBURGH

Magnifying manometer

BAKER-RAULANG COMPANY, CLEVELAND

Line of elevating trucks

BALDOR ELECTRIC COMPANY, ST. LOUIS

Line of ball-bearing, single-phase fractional-horsepower condenser motors

BARTLETT MANUFACTURING COMPANY, DETROIT, MICH.

Lineman tree trimmer with compact head

WALTER BATES STEEL CORPORATION, GARY, IND.

Mast for transmission line installations to fill the gap between poles and towers
Steel floor grating
Line of steel poles

BELDEN MANUFACTURING COMPANY, CHICAGO

Flat floor cords

BENJAMIN ELECTRIC MANUFACTURING COMPANY, CHICAGO

Sign lighting reflector
Heavy-duty lighting equipment
Porcelain socket extension for reflectors to accommodate new 100-watt Type A lamps

BERGER MANUFACTURING COMPANY, SOUTH BOSTON, MASS.

Steel meter rack

BERNITZ FURNACE APPLIANCE COMPANY, BOSTON

New type of boiler furnace water wall construction in which carborundum blocks cover the water wall tubes

BESSEMER GALVANIZING WORKS, BIRMINGHAM, ALA.

Galvanized-steel pole which was made to taper in both directions so as to contain no excess metal and yet give a pole of uniform strength

JAMES G. BIDDLE, PHILADELPHIA

"Megger" ground-resistance tester

BOWIE SWITCH COMPANY, SAN FRANCISCO

220,000-volt air-break switch

BOWSER & COMPANY, INC., S. F., FORT WAYNE, IND.

"Diskelectro" oil filter using the principle of edge filtration

BRISTOL COMPANY, WATERBURY, CONN.

Three-unit recording instrument, available as voltmeter or ammeter

BRYANT ELECTRIC COMPANY, BRIDGEPORT, CONN.

"Spartan" receptacles with round metal cover for mounting directly on boxes
Tumbler switch and receptacle combination
Bryant "Trigle" switch for use as a three-circuit electrolier switch

BUDA COMPANY, HARVEY, ILL.

Pole hole digger and pole erector

BUS STRUCTURE COMPANY, SPRINGFIELD, MASS.

Unit steel forms for construction of concrete cells for buses and allied plant and substation equipment

BUSH ELECTRIC COMPANY, CLEVELAND

Safety cartridge fuse remover

CENTURY ELECTRIC COMPANY, ST. LOUIS

Type DM direct-current motors

CHICAGO AUTOMATIC ELECTRIC BOILER COMPANY, CHICAGO

Automatic electric water heater

CHICAGO PUMP COMPANY, CHICAGO

Automatic alternator for automatically shifting the operation of two pumps

CLARK CONTROLLER COMPANY, CLEVELAND

Across-the-line starter with continuous rating of 75 amp.
Primary resistor squirrel-cage motor starter

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY, HARTFORD, CONN.

The "Foursome"—a multi-outlet device for domestic service
Line of externally operated inclosed switches for general service

COMMERCIAL TRUCK COMPANY, PHILADELPHIA

Electric truck designed for retail ice delivery

CONDIT ELECTRICAL MANUFACTURING CORPORATION, BOSTON

Switch house of sheet steel with electrically welded joints
Manually operated indoor oil circuit breaker, Type E-20
Motor-operated mechanism, Type MO-1, for alternating-current operation of moderate-capacity circuit breakers

CONDUO-BASE COMPANY, CLEVELAND

"Junior Conduo-Base" for flexible wiring of buildings

CONNECTICUT ELECTRIC MANUFACTURING COMPANY, BRIDGEPORT, CONN.

Current tap (Bakelite)
V-light tap
Decorative switch plates (Bakelite)

COPPERWELD STEEL COMPANY, RANKIN, PA.

Copperweld grounding chain

CORNING GLASS WORKS, CORNING, N. Y.

23,000-volt "Pyrex" pin-type insulator

CRAMER & COMPANY, INC., R. W., NEW YORK

Subway-type Sauter time switch

CROCKER-WHEELER ELECTRIC MANUFACTURING COMPANY, AMPERE, N. J.

Line of ball-bearing general purpose motors for both direct and alternating current

CROUSE-HINDS COMPANY, SYRACUSE, N. Y.

"Obround" condulets

CURTIS LIGHTING, INC., CHICAGO

"Curtisstrip" wireway for rigid wiring

CUTLER-HAMMER MANUFACTURING COMPANY, MILWAUKEE

Across-the-line starter for alternating-current motors up to 5 hp., Type C-H 9586 "AAA"
Magnetic blow-out contactors for direct-current mill-type contactors
Oil dash-pot with electrical contact for attaching to alternating-current magnetic contactors

DAMPNEY COMPANY OF AMERICA, BOSTON

"Apexior"—a compound for pickling boiler tubes and for preventing corrosion in new tubes

DAVIS EMERGENCY EQUIPMENT COMPANY, INC., NEW YORK CITY

Trouble finder for locating defects in transmission lines or equipment

DE LAVAL STEAM TURBINE COMPANY, TRENTON, N. J.

Centrifugal pump for high-pressure boilers

DELTA-STAR ELECTRIC COMPANY, CHICAGO

High-capacity indoor disconnecting switch
Standardized outdoor substation equipment
132-kv. gang-type motor-operated switch
220-kv. switch in which the blades first rise from the contacts and then turn horizontally
Vertically mounted gang-operated switch for disconnecting oil breakers, etc.
"PM form 2" 66-kv. gang-operated switch
Type MR gang-operated switch with ball bearings
Grounding switch for use on 132-kv. equipment
Single-pole single-throw front-connected indoor-type disconnecting switch, 4,000 amp., 7,500 volt
Unit-type bus support and spacer arrangement for heavy-capacity buses
Line of clamp insulator supports
High-capacity disconnecting switch, 6,000 amp., 7,500 volt, for indoor or outdoor service
Combination gang-operated disconnecting and grounding switch
Type PMF disconnecting and ground switch of the double-throw single-break type
High-capacity disconnecting switch, 2,000 amp. 7,500 volt
Disconnecting switch with blade mounted directly on oil-circuit breaker

DIEHL MANUFACTURING COMPANY, ELIZABETHPORT, N. J.

Line of roller-bearing textile mill motors

DUNCAN ELECTRIC MANUFACTURING COMPANY, LAFAYETTE, IND.

Type MD watt-hour meter
Type H current transformer for indoor use
Three-phase four-wire switchboard watt-hour meter

EDISON ELECTRIC APPLIANCE COMPANY, CHICAGO

"Peak-Limiter" for range and water heater circuits
Storage-type water heater
Portable air heater
Radiant fireplace heater
Continuous electric toaster

ELECTROHOT MANUFACTURING COMPANY, MINNEAPOLIS

Electric doughnut maker

ELECTRIC CONTROLLER & MANUFACTURING COMPANY, CLEVELAND

Cam-type limit switch for use with magnetic controllers
Full-voltage 2,300-volt automatic synchronous motor starter for low-speed synchronous motor using a magnetic clutch
Type WB magnetic brake
Type SA lifting magnet
Automatic synchronous motor starters for reduced-voltage or full-voltage starting
Ironclad tanks for Type 20 across-the-line switches

ELECTRIC MACHINERY MANUFACTURING COMPANY, MINNEAPOLIS

Static condenser with a multiple number of units in one container

ELECTRIC PRODUCTS COMPANY, CLEVELAND

Line of electroplating motor-generators

ELECTRIC REFRIGERATION CORPORATION, DETROIT

Three cabinet Kelvinators
Three condensing units
Two dairy coolers

ELECTRIC STEAM RADIATOR COMPANY, SAN FRANCISCO

Electric steam radiator

ELECTRO ENGINEERING COMPANY, INC., RICHMOND HILL, N. Y.

"Electro-Melter" soldering pot with four-heat control

ELWELL-PARKER ELECTRIC COMPANY, CLEVELAND

Electric industrial truck for handling newsprint material
Light-duty 2-ton tiering tructor.

EMERSON ELECTRIC MANUFACTURING COMPANY, ST. LOUIS

Wall boxes for ventilating fan motors for domestic use
Transparent mounting panels for kitchen ventilating fans

ERIE MALLEABLE IRON COMPANY, ERIE, PA.

"Kondu" threadless fittings to connect fiber conduit to metallic conduit

FAIRBANKS, MORSE & COMPANY, CHICAGO

Inclosed ventilated motor of the double squirrel-cage type
Line of double spirrel-cage motors using loose iron rods in each rotor slot between the inner and outer bars

FERRANTI, INC., NEW YORK

Complete outdoor type self-contained transformer unit of the forced oil-cooled type with pump cooler and piping all mounted on a bed plate. Built up to 110 kv., three phase, 50 cycle in capacity up to 13,333 kva.

FIDELITY ELECTRIC COMPANY, LANCASTER, PA.

Small rotary converter in which the voltage and frequency are held within 5 per cent variation

FORBES & MYERS, WORCESTER, MASS.

Frequency changer from 1/10 to 3 kva. for changing two- or three-phase 60-cycle current of any voltage to single-, two- or three-phase 180-cycle current of any voltage

FOXBORO COMPANY, INC., FOXBORO, MASS.

Tachometer

FRANKEL CONNECTOR COMPANY, INC., NEW YORK CITY

Bleeder tap for tapping a main feeder under limited space conditions

FUEL EFFICIENCY ENGINEERING CORPORATION, BIRMINGHAM, ALA.

"Warrior" unit pulverizer

G. & W. ELECTRIC SPECIALTY COMPANY, CHICAGO

Submersion-proof vault unit with or without automatic throwover
Automatic master control
Submersion-proof oil disconnecting switch with air disconnects on both sides
Oil-disconnecting pothead with oil-air break
"H & T" insulating sleeve for lead-covered cable sheath
Cable support
Two-way series cutout for lighting circuits

GENERAL ELECTRIC COMPANY

Inclosed generator control cabinet for use at unit and supervisory cabinet for use in conjunction therewith
Transformers eqtipped with potheads for direct connection to cables
500-kva. subway transformers
Motors and generators made with a frame of rolled-steel plate
High-speed automatic arc welder with two automatic welding heads
Gas engine-driven welding generator
Line of steel mill motors, MD-400 series
"U" tube connector between a transformer tank and its conservator
Vacuum-tube synchroscope
Atomic hydrogen welding equipment
Flow indicator for transformer water cooling
Time delay push-button station
Type FT induction motors for across-the-line starting
Automatic compensator of dustproof design
Welding electrode for the general welding of steel
Step-back relay for direct-current magnetic control equipment
Totalizing demand relay
Float switch, Type CR-2931-P
Portable test meter, Type IB-7
Split-core current-measuring set
Magnetic switch with temperature overload relays, Type CR 7006-D-20
High-low water alarm signal panel, Type CR-4779-A-1

Type I-16 single-phase watt-hour meter
Small limit switch for machine tool industry
Submersible fountain-type floodlight projector
Line of alternating- and direct-current solenoids, Type CR-9503
Traffic signal mechanism
Time delay push-button station CR-2904-BS-82-A
Small-capacity melting pot
Line of totally inclosed motors for portable hoists
Self-resetting undervoltage device with adjustable time delay
A portable and a stationary machine for undercutting mica
Preset theater-lighting control board
Dust-tight boilerplate inclosing cases for wall-mounted general-purpose starters
Switchboard panels hung on hinges
Reclosing feeder for mine service
Generators with surface air coolers mounted in inclosing duct surrounding frame.
"Selsyn" control and adaptation to a number of uses
Induction power factor relay
Induction temperature relay
Line of test blocks and plugs for testing
Line of control and transfer switches
Plunger relays of the PQ type
Speed control relay, Type MY1
Network relays, Type ID1
Device for detecting a trace of mercury in the atmosphere
Indoor switchboard type breaker for use where moderately high interrupting capacity is required
Submersible-type circuit breaker
Motor mechanism for operating circuit breakers of large isolated phase power stations
Trip-free solenoids for oil-circuit breakers
Outdoor motor mechanism of centrifugal type for larger oil-circuit breakers
Network protectors with motor-operating mechanism utilizing a centrifugal device
Single-pole motor-operated overload air-circuit breaker for steel mill and other work
Heating unit for drying large sand molds
Three small across-the-line reversing switches
Edgewise-wound resistor
Automatic welding equipment for making metal railroad ties
Coiled coil filament projection lamps
30-volt street-railway lamps
Mogul clamp base
Intermediate screw base
10-watt sign and decorative lamp for use with intermediate screw base
Socket receptacle with short-circuiting spring for series circuit
Canopy pull switch
Fan hanger
"GE-Flex" all rubber cord
15- and 30-amp. "Tungar" battery chargers

GIBB WELDING MACHINE COMPANY, BAY CITY, MICH.

Welding press which is a combination of an automatic spot welder and a punch press

GILLETTE-VIBBER COMPANY, NEW LONDON, CONN.

"Gee-Vee Bondit" bushings for grounding conduits

HART & HEGEMAN MANUFACTURING COMPANY, HARTFORD, CONN.

"Tumbolier" switches embodying three units in a single gang

HART MANUFACTURING COMPANY, HARTFORD, CONN.

Small single-pole remote control magnetic switch
White vitrified enamel timer
Four-post motor-reversing switch
Remote control switch, two or three pole, 300 amp.
Automatic throwover switch, two or three pole, 300 amp.

HAYES, C. I., PROVIDENCE, R. I.

Resistance-type furnace for continuous operation at 1,800 deg. F. to 2,500 deg. F. and intermittent operation up to 2,800 deg. F.

HAZARD MANUFACTURING COMPANY, WILKES-BARRE, PA.

"Loxsteel" single strip armored cable

HI-VOLTAGE EQUIPMENT COMPANY, CLEVELAND

Line of outdoor switching equipment with Monel-metal ball bearings set in bronze races
4,000-amp., 11,000-volt gang-operated disconnecting switch
Disconnecting type fuse for voltages up to 40,000 and currents up to 175 amp.
132,000-volt air-break switch equipped with outriggers to maintain clearances to ground for the leads
Heavy duty Monel ball-bearing, 132,000-volt gang-operated disconnecting switch

HIGHWAY TRAILER COMPANY, EDGERTON, WIS.

Highway earth-boring machine

HORACE HILLS, INC., SAN FRANCISCO

"Starrett" cable cutter for cutting wire cable and holding the blunt ends

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICH.

Totally inclosed self-ventilating motor with Timken bearings and automatic bearing adjuster

HUBBARD & COMPANY, PITTSBURGH

Peirce "Presteel" trolley mast arm in both the rigid type and the chain type
Peirce forged-steel pin for corner and angle construction

HARVEY HUBBELL, INC., BRIDGEPORT, CONN.

"Acorn" screwless plates
"Acorn" switches, receptacles, caps and connections
"Loxin" lamp

HYDROIL SALES CORPORATION, LEBANON, IND.

Continuous oil-testing equipment

HYNES & COX ELECTRIC CORPORATION, ALBANY, N. Y.

"Red Crown" water heater

ILER ELECTRIC SERVICE COMPANY, YOUNGSTOWN, OHIO

Line "Tensiometer" to measure the pull of guy wires
Voltage relay alarm

ILLINOIS ELECTRIC PORCELAIN COMPANY, MACOMB, ILL.

Switch rod insulators and coupling for mounting in series

INDIANA TRUCK CORPORATION, MARION, IND.

Model III, 1½-ton chassis, equipped with special utility body and pole setter
Truck pole setter mounted on 2-ton chassis

INDUSTRIAL CONTROLLER COMPANY, MILWAUKEE

Automatic starter with motor-testing device
Float switch
Skip-hoist control, semi-automatic and fully automatic type
Automatic alternating-current starter for motors up to 5 hp.

INGERSOLL-RAND COMPANY, NEW YORK

Feed-water pump for 1,600-lb. pressure

JEFFERY-DEWITT INSULATOR COMPANY, KENOVA, W. VA.

One-piece solid porcelain pin-type insulators for voltages from 11 kv. to 50 kv.

JEWELL ELECTRICAL INSTRUMENT COMPANY, CHICAGO

Line of alternating-current meters utilizing a movement of new design
"Master" portable instrument

JOHNS-MANVILLE CORPORATION, NEW YORK

"Superex" insulation for furnaces and other high-temperature equipment

JOHNSON MANUFACTURING COMPANY, ATLANTA, GA.

Gang-operated automatic series solenoid trip-free circuit breaker

WALTER KIDDE & COMPANY, NEW YORK CITY

Rich audible smoke detector for protecting rotary machines and automatic substations

JAMES R. KEARNEY CORPORATION, ST. LOUIS

Outdoor expulsion-type fuse switch
Expulsion-type porcelain plug cutout

KEYSTONE CARBON COMPANY, EMPORIUM, PA.

Brush material composed of pure copper and graphite

LANDERS, FRARY & CLARK, NEW BRITAIN, CONN.

Super-automatic safety iron with finger tip control and automatic indicator

LAPP INSULATOR COMPANY, INC., LEROY N. Y.

Fog-type insulators

LEEDS & NORTHRUP COMPANY, PHILADELPHIA

CO_2 meter based on the thermal conductivity method

LIBERTY ELECTRIC CORPORATION, STAMFORD, CONN.

Liberty "Syncroverter"—a commutating rectifier for battery charging

LINCOLN ELECTRIC COMPANY, CLEVELAND

Shell-type motor of all welded design
Portable arc-welding machine of welded construction
Welding rod with which current densities of 15,000 amp per square inch or more are used. Available in sizes up to ½ in. diameter and 14 in. long
Automatic carbon arc welder for welding the horizontal seams of range boilers, also a machine for welding the bottom seams, and another for welding heads of range boilers or other cylindrical tanks
Welded steel motor frames
All-steel line of ball-bearing induction motors
Heavy current metal electrode holder

Machine-driven carbon arc welder for welding circular seams up to 12 in. in diameter with method of cooling the work undergoing welding
Arc butt welder

LINDEMANN & HOVERSON COMPANY, MILWAUKEE

Flush-type air heater

LINE MATERIAL COMPANY, SOUTH MILWAUKEE, WIS.

Strain-type tilting insulator switch for pole-top mounting
Fuse for 4,400-volt circuits
Porcelain duct entrance for manholes

LINK-BELT COMPANY, CHICAGO

Speed reducer for general service
Belt conveyor idler with roller bearings

LUNDIN ELECTRIC & MACHINE COMPANY, BOSTON

Portable radio interference instrument

MATTHEWS CORPORATION, W. N., ST. LOUIS

5,000-volt fuse switch and disconnecting switch for outdoor use
Slack puller for 6,000-lb. strains and an arrangement which permits strains up to 1,000 lb. to be taken up speedily
Fast-blowing fuse links
"Traplox" anchor
"Xpandix" anchors
"Strainometer" for measuring pull up to 3,000 lb. in wires
300-amp knife switch for 7,500-volt or 11,000-volt service

MCGILL MANUFACTURING COMPANY, VALPARAISO, IND.

"Twi-lite" series multiple switch

MCGILL METAL COMPANY, VALPARAISO, IND.

Deep groove ball bearings

MEAD-MORRISON MANUFACTURING COMPANY, BOSTON

Transformer handling crane for mounting on truck

MORSE CHAIN COMPANY, ITHACA, N. Y.

New design "55" type chain

NATIONAL METAL MOLDING COMPANY, PITTSBURGH

Series of house brackets for electric service connection

NEW ERA ELECTRIC RANGE COMPANY, NEW YORK CITY

Portable insulated electric range

NEW MONARCH MACHINE & STAMPING COMPANY, DES MOINES, IOWA

Arc welder for production and repair welding of cast and malleable iron and steel parts

NEW YORK ENGINEERING COMPANY, NEW YORK CITY

Apparatus for cooling or congealing oil or compound used in the impregnation of power cables

NILSON-MILLER CORPORATION, HOBOKEN, N. J.

Flexible tension motor base

NORTHWESTERN MANUFACTURING COMPANY, MILWAUKEE

Hansen arc welder with single control

OHIO BRASS COMPANY, MANSFIELD, OHIO

Dead-end assembly for low-voltage feeder cable
Cable splice and dead end
Electrostatic condensers for coupling carrier-current equipment on 220,000-volt and 110,000-volt lines

OHIO ELECTRIC & CONTROLLER COMPANY, CLEVELAND

Fractional-sized motor-generator set for direct-current relay operation from an alternating-current service
Torque motors for elevator controls, operating cams, relays, etc.

PACIFIC COAST STEEL COMPANY, SAN FRANCISCO

Snow tower for transmission lines

PACIFIC ELECTRIC MANUFACTURING COMPANY, SAN FRANCISCO

Motor-wound spring-operated control mechanism for vertical plunger-type breakers
Type S group-controlled disconnecting switches
Rocker insulator-type group-controlled disconnecting switch
Type OA instrument current transformer
Type MW spring-actuated motor-wound oil-circuit breaker control mechanism

PACKARD ELECTRIC COMPANY, WARREN, OHIO

Subway-type transformers
Short-circuiting and grounding switch for transformers
Line of indoor dry-type potential transformers for instrument service

PAGE ENGINEERING COMPANY, SYRACUSE, N. Y.

"Bulldog" endless guarded cable grip

PALMER ELECTRIC & MANUFACTURING COMPANY, CAMBRIDGE, MASS.

Dual-service entrance control switches for duplicate feeders
Line of accessible safety switches, classification "AA" from 30 amp. to 600 amp. with two, three or four poles for single- or double-throw service.

PASS & SEYMOUR, INC., SYRACUSE, N. Y.

Socket caps with cord grips
Attachment plug caps with cord grips
"Alabax" line of porcelain wiring devices

JOHN I. PAULDING, INC., NEW BEDFORD, MASS.

Line of interchangeable porcelain sockets

PEABODY ENGINEERING CORPORATION, NEW YORK

"Toronto" powdered-coal burner

PHILADELPHIA ELECTRICAL & MANUFACTURING COMPANY, PHILADELPHIA

Adjustable street-lighting unit adapted for aërial or underground wiring
"Nofilm" series socket

PLIBRICO JOINTLESS FIREBRICK COMPANY, CHICAGO

"Flexo-anchor" for anchoring jointless furnace lining walls

PYLE-NATIONAL COMPANY, CHICAGO

Heavy-duty, 2½-kw., portable self-contained generator
Floodlight lens with 45 deg. circular divergence

PYROMETER INSTRUMENT COMPANY, NEW YORK CITY

"Pyro" radiation pyrometer

RAILWAY & INDUSTRIAL ENGINEERING COMPANY, GREENSBURG, PA.

Type TTR "Hi-pressure" contact switch
Underground-type hook-operated disconnect switch, 37-kv., 400-amp., Type DI-3
"Franklin" heavy-duty multiple-cable bus support using die-cast metal construction

RAWSON ELECTRICAL INSTRUMENT COMPANY, CAMBRIDGE, MASS.

Portable-type electrostatic voltmeter in ranges from 100 to 2,500 volts

REX MANUFACTURING COMPANY, CONNERSVILLE, IND.

Metal cabinets for electrical refrigeration
Display cabinets for electrical refrigeration

REYNOLDS ELECTRIC COMPANY, CHICAGO

Color hood holders for sign work
Dimmer flasher
12-quart mixer and kitchen machine
Unit flasher

RITER-CONLEY COMPANY, PITTSBURGH

Transmission towers with revolving cross-arms

ROCHESTER ELECTRIC PRODUCTS CORPORATION, ROCHESTER, N. Y.

Diverter-pole generator for charging bus control batteries

ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN, CONN.

Rockbestos "3000" heater cord

W. S. ROCKWELL COMPANY, NEW YORK

Revolving retort-type electric furnace

ROLLER-SMITH COMPANY, NEW YORK CITY

Ohmmeter Type COM
Circuit tester for locating open circuits in coils and circuits
Type FR relays for use with contact-making instruments on alternating or direct current
Type RR reverse current relay
Mechanical lock-out attachment for circuit breakers

ROTH BROTHERS & COMPANY, CHICAGO

Automatic emergency lighting system
Line of motors and generators from ¼ hp. to 7½ hp. with maximum interchangeability

ROYAL ELECTRIC MANUFACTURING COMPANY, CHICAGO

Pole-top switch with pyramid contact
Transformer cutout in the form of a fuse disconnect switch

SCHWEITZER & CONRAD, INC., CHICAGO

Pantograph switch for 2,200-volt to 7,500-volt service
Type DLC ½-amp fuse for potential transformer protection
Wire-wound resistor
Fuse, current-limiting resistor and disconnecting switch combination

SENTRY COMPANY, TAUNTON, MASS.

"Globar" type electric heating furnace for hardening high-speed engine valves
Electric furnace, 1½ kw., for research and thermal analysis on ferrous and non-ferrous alloys
Model "HS" electric furnaces for high-speed steel hardening and refractory testing

SHEPARD ELECTRIC CRANE & HOIST COMPANY, MONTOUR FALLS, N. Y.

Standard-type crane trolley using steel plate and angle construction and steel tubing

SOUTHERN STATES EQUIPMENT COMPANY, BIRMINGHAM, ALA.

Expulsion fuse in which the fuse tube is thrown out of circuit when the fuse link is ruptured

Two-insulator 110-kv. disconnect switch
Disconnect switch for handling current transformers
Operating mechanism for outdoor switch

SQUARE D COMPANY, DETROIT

Convertible power panel
Distribution cabinet with accessible main fuse switch
Automatic across-the-line starter, push-button control up to 7½ hp.

STAR ELECTRIC MOTOR COMPANY, NEWARK, N. J.

Line of alternating and direct-current ball-bearing motors of the self-starting across-the-line type.

STATES COMPANY, HARTFORD, CONN.

Two high-tension automatic switches
Cycle counter
Switch-type test blocks for meter and relay testing
Push-pull relay switch for relay testing
Phantom load for attaching to rotating standard for meter testing

STEPHENS-ADAMSON MANUFACTURING COMPANY, CHICAGO

Line of belt conveyors
"JFS" variable speed transmission in sizes to transmit from ½ hp. to 15 hp. at the maximum reduction

HERMAN H. STICHT & COMPANY, NEW YORK CITY

"Standco" pocket size tachometer
Ground-resistance meter

B. F. STURTEVANT COMPANY, BOSTON

Air-conditioning equipment for bakeries
Line of ball-bearing polyphase induction motors
Air economizers
Lead-coated extended surface Type Y economizer
Tubular air heater
System of automatic nozzle control for small steam turbines
Line of multi-stage centrifugal compressors

SUNDH ELECTRIC COMPANY, INC., NEWARK, N. J.

Automatic transfer switch

TANNER ENGINEERING COMPANY, LONG ISLAND CITY, N. Y.

Remote indicator for indication of water level, etc.

THERMOGRAY COMPANY, JEFFERSON, IOWA

New line of water heaters
Time switch for water-heater control

THONER & MARTENS, BOSTON

Locking type of transfer switch

TIP'S TOOL COMPANY, INC. (Successor to IMPROVED HOTLINE EQUIPMENT COMPANY), TAYLORSVILLE, ILL.

Wire tong supports
Rubber glove bags
Wedge wire puller
Universal tool set

TRANSELECTRIC COMPANY, INDIANAPOLIS, IND.

Grounding set for grounding a three-phase line

HAROLD E. TRENT COMPANY, PHILADELPHIA

Melting pot for solder, lead, etc.

TRICO FUSE MANUFACTURING COMPANY, MILWAUKEE

Renewable fuses

TRUMBULL ELECTRIC MANUFACTURING COMPANY, PLAINVILLE, CONN.

Line of 600-volt double-throw safety switches, quick-make-and-break action
Type A meter service switch

TRUMBULL-VANDERPOEL ELECTRIC MANUFACTURING COMPANY, BANTAM, CONN.

T-V air-current breaker

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

Welded-steel poles

U. S. ELECTRICAL MANUFACTURING COMPANY, LOS ANGELES

Automatic self-start ball-bearing asbestos-insulated motor

UNION METAL MANUFACTURING COMPANY, CANTON, OHIO

Fluted steel pole

UNION SWITCH & SIGNAL COMPANY, SWISSVALE, PA.

Union rectifier and associated relays for control of automatic signals
Three-lever unit table interlocker
Power transfer relay

UNIVERSAL CRANE COMPANY, CLEVELAND

Truck crane fitted with crawler track

UTILITIES SERVICE, INC., TROY, PA.

A 300-watt and a 1,500-watt hydro-electric emergency lighting unit

WADSWORTH ELECTRIC MANUFACTURING COMPANY, COVINGTON, KY.

Porcelain base sealed service fuse switch with test links for both single-phase and polyphase service

WALKER COMPANY, O. S., WORCESTER, MASS.

Magnetic chuck of double-faced type

WALKER VEHICLE COMPANY, CHICAGO

1,500-lb. electric truck for trouble hunting

WARD LEONARD ELECTRIC COMPANY, MOUNT VERNON, N. Y.

Line of inclosed automatic direct-current motor starters of the counter-electromotive force type

WELSBACH COMPANY, GLOUCESTER, N. J.

Line of low-pressure electric refrigerators

WESTERN ELECTRIC COMPANY, NEW YORK

Loading coil for telephone lines using powdered "permalloy" cores
50-kw. radio broadcasting equipment

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

600-hp. oil-electric locomotive for switching service (weight 80 tons)
Oil-electric locomotive generator for 2,000-hp. oil engine
Electric furnace for normalizing shafts and box carburizing
Pusher furnace for piston pins, bolts, small shafts, etc.
Rotary hearth electric furnace for heat treating small pieces
Change house heater for use in construction work
Electric heater for railway track switch
Portable electric welder
Automatic emergency power unit
300-kva. network transformer, subway type, with tap changer
Small 10,000-r.p.m. polyphase motor for portable drills
Network protector subway type
7,500-volt, 25-kw. direct-current generator
Subway oil-circuit breaker, electric operation and trip
"Sentinel" circuit breaker for small motors applied to washing machines, etc.
Airport projector for lighting airplane landing fields
Turbine units of the geared turbine type
Plug fuse type panelboard
Type RW air-break disconnecting switch with arcing horns
Type OB polyphase watt-hour meter
Type OB two-element three-wire watt-hour meter
24-in. floodlight projector, Type SCA-24
Lightning arrester for alternating-current systems operating at 65 volts or less and direct-current systems operating at 45 volts or less
Distribution transformers for industrial application, Types SB and SKB
Outdoor switchhouse with steel panel
Type RH totally inclosed motor for mines
Type OB portable standard watt-hour meter
Line of magnetic control for mine hoist service
Line of secondary network transformers
Dust-tight and oil-immersed line starters
Meter-testing device
Direct-connected turbine generator unit of 3-kw. capacity
Time-delay device for low-voltage release

O. C. WHITE COMPANY, WORCESTER, MASS.

Adjustable fixtures and portables

EDWIN L. WIEGAND COMPANY, PITTSBURGH

High-speed closed unit for electric range

FRANK E. WOLCOTT MANUFACTURING COMPANY, HARTFORD, CONN.

Waffle iron
Reversible toaster
Household iron with thermostatic control
Therapeutic combination lamp
Therapeutic hand lamp
Automatic safety control cord with thermostatic control for alternating-current service
Variable heat control cord for flat-irons for alternating-current service
Line of table sets as percolators, toasters, etc.

WOODS COMPANY, S. A., BOSTON

Motor-driven saw from 1 hp. to 10 hp.

WOODWARD GOVERNOR COMPANY, ROCKFORD, ILL.

Mechanical timer for waterwheel governors

WORTHINGTON PUMP & MACHINERY CORPORATION, NEW YORK

High-efficiency centrifugal pumps

YALE & TOWNE MANUFACTURING COMPANY, STAMFORD, CONN.

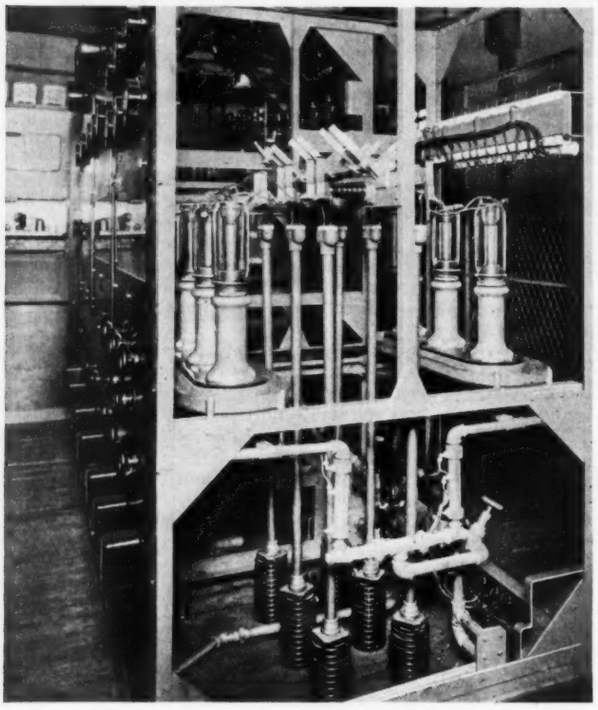
Heavy-duty 5-ton industrial truck
Model K25 3-ton high-lift elevating truck

YARNALL-WARING COMPANY, PHILADELPHIA

Boiler water column and inclined water gage

Broadcasting Equipment Has High Service Characteristics

A NEW 50-kw. radio broadcasting transmitter developed by the Bell Telephone Laboratories for the Western Electric Company has been under test at the experimental station of the Bell Telephone Laboratories for some months, broadcasting usually at weekly



POWERFUL BROADCASTING TRANSMITTER USES 17,000-VOLT RECTIFIER TUBES

intervals and between the hours of midnight and 4 a.m. Enthusiastic reports of the quality of its transmission have been received from all over the United States and provinces of Canada, as well as from Hawaii, New Zealand, Australia, Honduras, Bermuda and the Cook Islands. A remarkably low noise level was reported. This is a characteristic of the transmitter and is due to the high percentage of modulation.

The transmitter uses 25 vacuum tubes, of which fourteen are water cooled. These tubes and their related circuits are mounted on and behind ten panels. The frequency of the carrier wave is controlled by the oscillation of a small quartz plate, cut from a single crystal, with proper orientation as to the crystalline and optical axes. This plate, when carefully ground to a thickness determined by the desired frequency, is then associated with a master oscillating circuit. As one precaution to insure undeviating frequency, the plate is mounted in a container where its temperature is held constant.

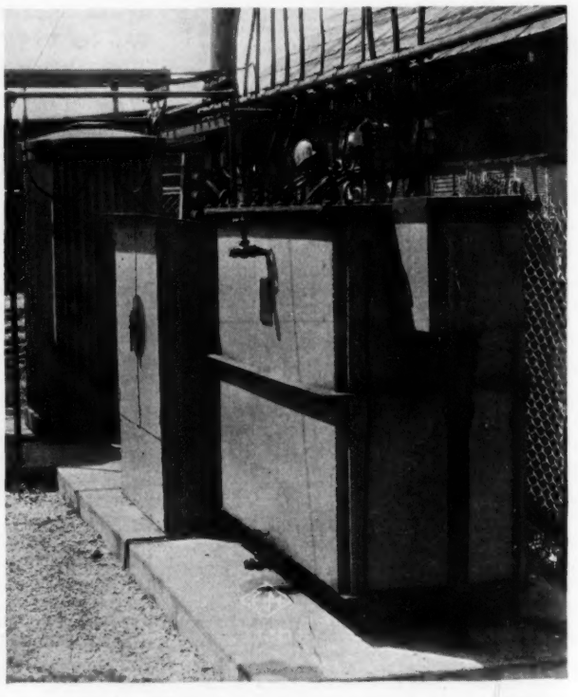
Speech currents from the control room are amplified by two stages in the set proper. The output voltage from the last of these is used for modulation. The radio frequency generated by the vacuum tube under control of the crystal is amplified in five stages. On the plate voltage of the second-stage tube is superposed the audio-frequency voltage for modulation. The audio-frequency voltage is sufficient to effect complete, or 100 per cent, modulation of the carrier oscillation. The modulation stage is followed by three more stages of radio-frequency amplification, each of which is a push-pull circuit. Water-cooled tubes are used in the last two stages; two in one and six in the other. Tuned circuits form the interstage couplings and also transfer the output power to a transmission line that leads out to the antenna system. In the final tuned circuit, currents as great as 100 amp. may flow through the heavy copper tubing of the inductance coils. Such care has been taken in the elimination of harmonics that the radiation of the second harmonic is said to be one five-hundred thousandth of the fundamental radiation.

Static Condenser Employs New Type Units

A NEW type of static condenser incorporating several unusual features has recently been installed at the plant of the Illinois Glass Company, Gas City, Ind. This 185-kva., three-phase, 60-cycle, 2,200-volt equipment is mounted in a single tank. The control panel for the device, equipped with a hand-operated oil-circuit breaker, with overload relays and no-voltage release, is mounted on a slate panel and is complete with current transformers and two potential transformers.

The design of this type of static condenser enables the use of a number of condenser units in one container. Each of these Electric Machinery Manufacturing Company condensers consists of an assemblage of small cylindrical rolls, immersed in oil. Each individual roll is a complete condenser, made up of interleaving layers of foil and tissue paper. The rated voltage of a roll is 220, 440 and 550, depending upon the number of interleaving tissues used in the construction. Corrugated concentric spacers provide for free circulation of oil through the body of each of the rolls, which are assembled in standard racks and connected in parallel or series according to the voltage required.

The advantages realized by the use of this construction are said to include long life, due to avoidance of



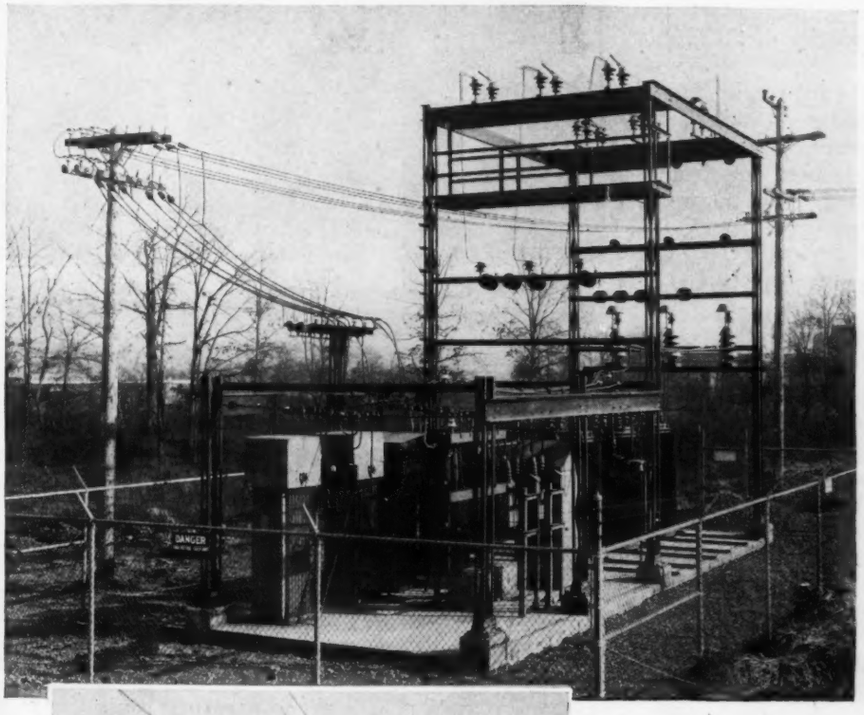
WEATHERPROOF STATIC CONDENSER SERVES IN OUTDOOR SUBSTATION

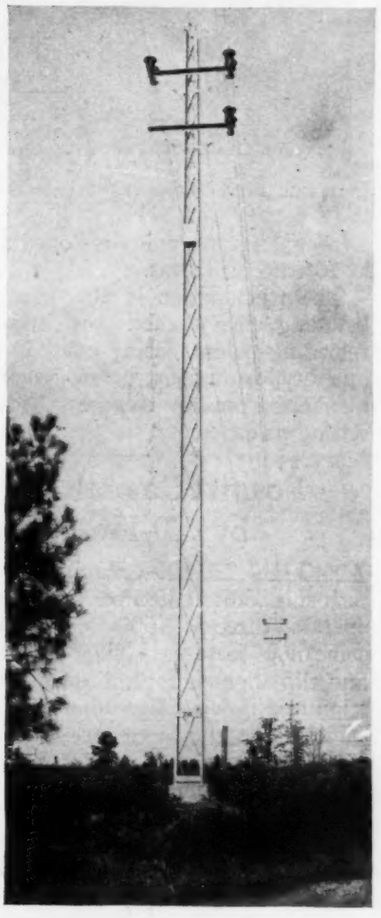
mechanical pressure on the dielectric and low unit roll capacities, avoiding high temperatures, as well as the absence of moving parts; high efficiency, and low installation and maintenance costs.

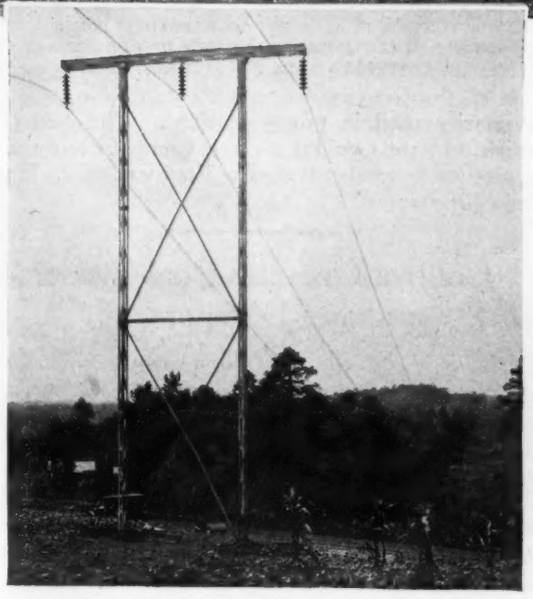
Line Supports and Substations Use Welded-Expanded Steel

THREE examples of the use of welded-expanded steel structures fabricated by the Truscon Steel Company are illustrated. The poles support a 44,000-volt circuit in Alabama with 330-ft. spans. It is reported that construction of the substation shown was expedited by the use of the structural members employed. The columns can be made of painted copper-alloy steel, standard steel or hot-dip galvanized steel, the first providing a particularly rustproof combination. The semi-flexible H-frame line supports keep the structure and conductors relatively low and therefore less subject to lightning disturbances.

STRUCTURAL MEMBERS AND LINE SUPPORTS OF WELDED-EXPANDED STEEL OFFER SERVICE AND ERECTION ADVANTAGES







Ten-Ton Portable Crane Aids Utility

IN EXTENDING its circuits a big Eastern power company recently found it necessary to replace all existing transformers with larger size units. Some of the new transformers weighed 10 tons each and to handle them a 10-ton Universal crane was mounted on a 7½-ton Mack truck. The method by which this unit was applied to the work is as follows:

The regular procedure is to send the crane out with a ½-yd. clamshell bucket and dig the manhole. After the excavation has been made the walls and bottom of the manhole are concreted. In the meantime, the crane is driven to some other location to either dig more manholes or place transformers.

In two or three days the manhole is ready for the transformer, and the crane is again driven back to the job. The 10-ton transformers are delivered on trucks or trailers, which are driven up along side the crane. The crane unit is then rotated over the side and picks up the transformer enough so that the truck can be driven out from underneath it, then the crane is rotated so that the transformer is over the manhole, into which it is then lowered.

In handling a 10-ton transformer the crane truck is blocked up with outriggers to insure full stability. Then the crane can be swung with its 10-ton load through 90 deg. over the rear end of the truck, and 45 deg. on each side of the center line.

These transformers are filled with oil and are reported to be worth $5,000 to $6,000 apiece, so that the utility must have the utmost confidence in the ability of both the truck and crane to stand up under these heavy loads.

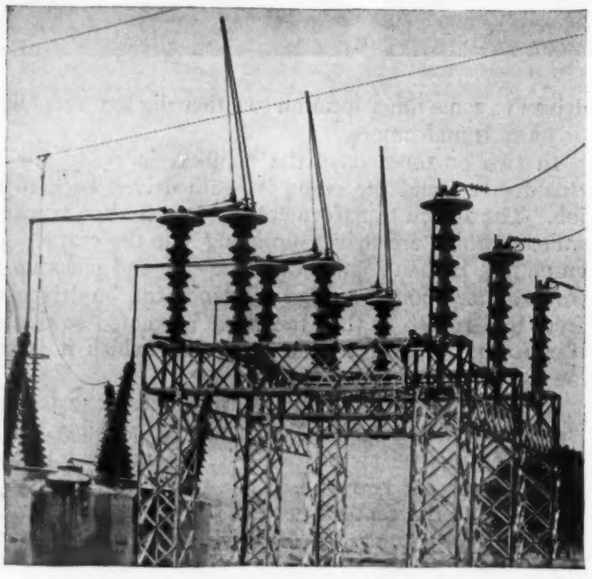
HANDLING A 10-TON TRANSFORMER WITH A PORTABLE CRANE

During tests the unit developed a capacity of 23,225 lb. at 10 ft. 6 in. radius.

The truck crane is also used in yard-service work, handling heavy cable reels, unloading, stacking and reloading poles, placing poles in creosote pits, etc. On other types of construction work it is used for digging manholes, conduit trenches, backfilling, clean-up work, setting poles, etc.

Positive Smooth Action Afforded by 220-Kv. "Disconnect"

IN THE 220,000-volt circuits of the Southern California Edison Company at Saugus, Calif., are gang-operated three-pole 600-amp. air-break switches that have some new features. They are designed to assure blade and clip alignment, require small manual effort for operation and prevent slamming of the blade at extremes of travel. The hinged contact clip, toggle break and piston-type buffer provide rapid but smooth operation of the switch. It was manufactured by the Bowie Switch Company.

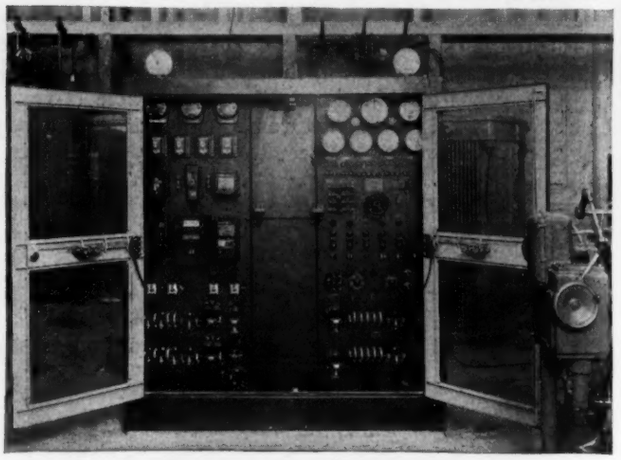


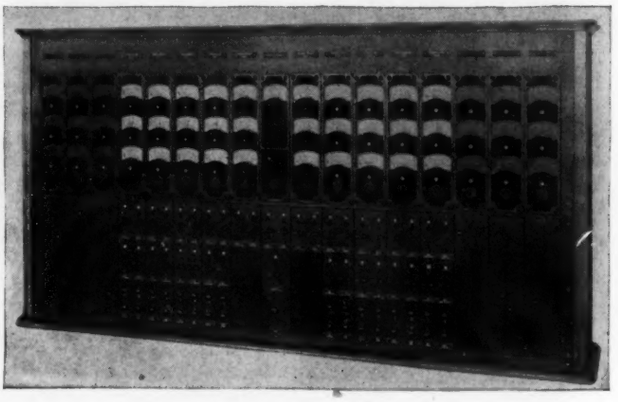
HINGED CONTACTS, TOGGLE BREAK AND DASH-POT BUFFERS ARE FEATURES OF THIS 220-KV. DISCONNECT

Generator Control at Each Unit Supervised by Dispatcher

EQUIPMENT for controlling each of the generating units at the Louisville (Ky.) Hydroelectric Company's new station is housed in a control cubicle immediately adjacent to the generator controlled. This is done to avoid lengthy and often complicated control-conduit layouts and to save installation cost. With this equipment the control of the units is placed at each one, but operations are supervised from the dispatcher's office through the control board shown in the illustration.

This board takes the place of the type of switchboard



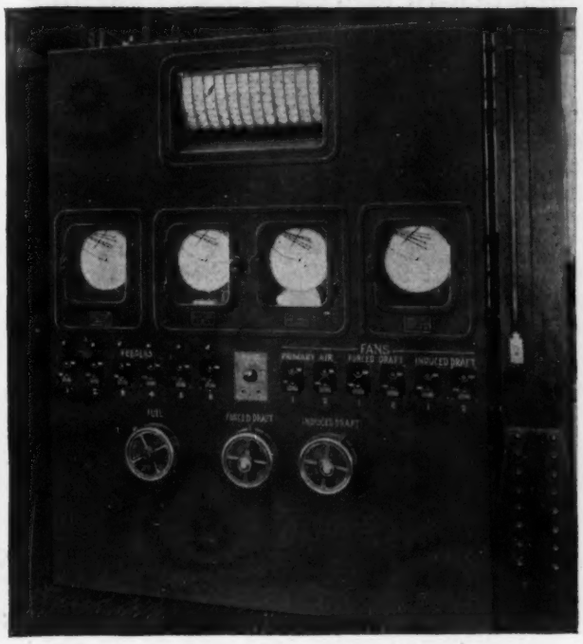


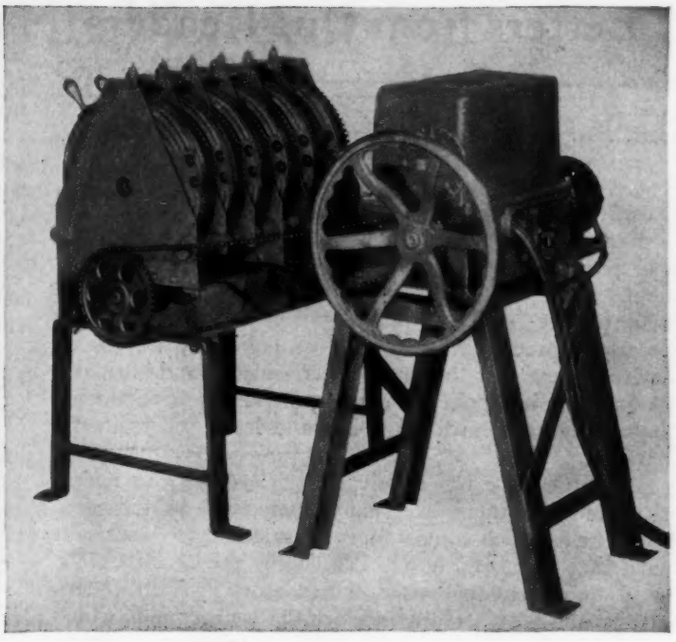
GENERATOR CONTROL IS ADJACENT TO HYDRAULIC CONTROL OF EACH UNIT IN LOUISVILLE PLANT, BUT OPERATIONS ARE SUPERVISED FROM DISPATCHER'S BOARD

customarily used in power stations. The control was furnished by the General Electric Company and the plant was designed by the Byllesby Engineering & Management Corporation.

Control Operates Coal Feeders and Dampers

CONTROL of the 1,300-lb. pressure boilers at the Lakeside station of the Milwaukee Electric Railway & Light Company is centered in boiler room panels and equipment made by the Bailey Meter Company, which has recently developed a new drive for use with its control equipment. This drive is small and compact and lends itself readily to installation in small space adjacent to the controlled devices. One of the new control drives connected to a bank of six pulverized coal feeder rheo-





CONTROL BOARD FOR 1,300-LB. PRESSURE BOILER AT LAKESIDE STATION OF MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY AND CONTROL DRIVE FOR SIX PULVERIZED-COAL FEEDER RHEOSTATS

stats is illustrated. Each of these drives consists of a continuously running motor and a train of gears through which the dampers, fuel feeder rheostats, etc., are advanced or retarded, depending on whether the "more" or "less" clutch of a pair of solenoid-operated clutches is engaged. These clutches may be operated automatically by motor-driven or solenoid-operated contactors responsive to changes in steam pressure, "steam flow-air flow" relation or furnace draft. They may be operated by push button in case it is desired to operate the boiler on base load.

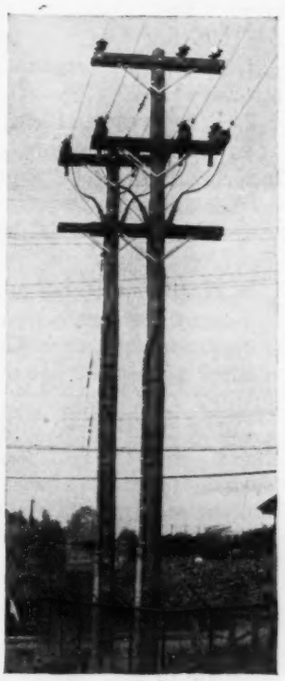
Electrically Heated Wax Pots Used by Fuller Brush

FROM a small and experimental beginning, the electric pot for melting cement has replaced all other forms of pot heating at the factory of the Fuller Brush Company, Hartford, Conn., and units of the type illustrated have been installed in all branch factories of this company as well. The cement is used in filling brush handles, and the capacity of each pot is 1 gal. Six 200-watt cartridge-type heating units are fitted into a cast-iron base beneath the pot, and the temperature is controlled by a three-heat switch for low-, medium- and high-heat service. The pots are covered with 2 in. of asbestos cement to prevent excessive radiation, and a copper rod is inserted in the center of the pot to conduct the heat up through the cement. The flow of wax is governed by a valve controlled by a pedal. The pots were designed by the Fuller company in co-operation with the General Electric Company.

MELTING POTS FOR WAX CEMENT ARE ELECTRICALLY HEATED IN FULLER BRUSH FACTORY

Parkway Cable for 19-Kv. Circuits at Substation

THE use of 19,000-volt parkway cable to take distribution feeders from the substation transformer bus underground to the first distribution pole is shown in the accompanying illustration. This installation is at the Davis Street station of the Georgia Power Company in Atlanta. Due to the congestion that would result if all lines were taken out of the station overhead, the company decided to go to parkway cable. This was done with both the 4,000-volt commercial feeders and the 19,000-volt feeders, the latter tying into the 19,000-volt loop surrounding the city of Atlanta. The installation shown consists of No. 4/0 three-conductor parkway cable, manufactured by Okonite-Callender Cable Company, and is protected at the base of the pole by a short length of conduit.



PARKWAY CABLE USED TO TAKE 19,000-VOLT CIRCUITS OUT OF SUBSTATION

Letters from Our Readers

Purchasing Policy—On What Should It Be Based?

To the Editor of the ELECTRICAL WORLD:

Engineering puzzles cannot compare with the paradoxical purchasing policies met with in the public utility field. I believe many of your readers, those who design, manufacture and sell high-tension materials, would greatly appreciate a statement of policy by buyers of such equipment as to what they consider sound business-like purchasing policy. Many purchasing departments apparently have no fixed policy and leave sellers in the dark.

Buying can be based only on price, quality or necessity, and yet there are many companies in the electrical field which almost defy a salesman to ascertain what they want and how. With some the decimal point on a quotation spells the whole story. With others quality and past performance are the backgrounds which control their orders. With many purchasing is not a science but a game of wits, in which the fast thinker wins. We have all had the experience, when motoring, of being held up in a long line of cars, only to find out that a slow car heads the procession. In the same way, a utility company that has slowly developed a stable, known, purchasing policy of fair play is more than likely to head the procession than a company whose buying policy is a hit-and-run game of wits.

What price? is a simple question with a complicated answer. The buyer asks the question and then answers it. Actually anything offered for sale is on the auction block of public opinion. Value is the equator where minds and money meet, but there are many buyers who don't know their equators. A seller will tell only the first cost. The buyer must estimate for himself the last cost. Many buyers stop at first cost and forget to analyze the following five-point test of a good purchase:

1. What life expectancy may be looked for in this purchase?
2. What wear and tear will this purchase stand?
3. What obsolescence—or, if this article is purchased today, will there be a greatly improved article on the market tomorrow?
4. Will this material be adequate for the desired purpose?
5. Has this material an inherent vice or flaw?

When these points are established, the decimal point in a quotation is almost lost sight of and the buyer has reached a scientific balance between fair price and good quality.

Public utilities are judged by more than their balance sheets. Investors of the wise and successful type are learning to study precise details before buying heavily into the securities of a company. One group of banking investors makes a special investigation of purchasing policies with results that are uncannily successful. Recently, a seemingly insignificant visit to a certain purchasing department was the final analysis that started the stock of the company on an upward rise of fifteen points. Needless to say, that concern's buyers had an established policy of good faith toward its sources of supply and was basing its purchases not on cut price but the necessity of future quality.

Purchasing is far more than a game of wits. Interconnection is being accomplished physically, and it is the writer's sincere belief that much good can be accomplished by more interconnection and frankness between makers and users of high-tension material.

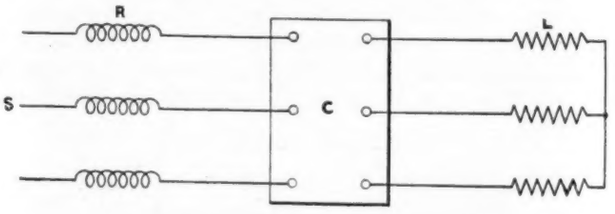
Before the buyer strikes back and inquires about a selling policy, I will say that, as I see it, business is not a game. To be sure, there are two sides. On one side is the buyer and user, the public utility. On the other side is the seller, the manufacturer. But a game requires different goals, and in this case we believe the public utility's goal and the manufacturers' are the same—high-class material and fair price. And may it be remembered, after looking at any junk pile, in any power house, that material in this field can never be made too well for the speed with which things are evolving electrically.

H. G. LAPSLEY,
District Manager.
General Devices & Fittings Company,
New York, N. Y.

Position of Circuit Breaker Determines Duty

To the Editor of the ELECTRICAL WORLD:

In making circuit-breaker tests such as the one on the Commonwealth Edison Company system described in the July 16 issue of the ELECTRICAL WORLD by William M. Scott of the Cutter Electrical & Manufacturing Company of Philadelphia, the breaker was at the end of the circuit, and therefore there was practically no potential between the phases at the start of the opening operation. Therefore there was no initial tendency for the three arcs to intercommunicate and result in a real short



CONNECTIONS FOR CIRCUIT BREAKER TESTS

S, three-phase source of power. *C*, circuit breaker under test. *L*, load for regulating amount of power to be interrupted by breaker under test. *R*, protective reactors of low value to limit possible flow of current from source in case of a short circuit between phases at breaker.

circuit, as would be the case in regular practice. This is indicated by the relative position of the three arcs as shown in the illustration (Fig. 4).

If the breaker had been placed between the supply and a load instead of at the end of a circuit having no power load, the results would have been very different, for the breaker would have probably short-circuited from pole to pole. Further, when the load is beyond the breaker, the load itself possesses electrical energy—electromagnetic energy—and this reacts upon the circuit breaker when opened to disconnect a live load or short-circuited piece of apparatus.

The proper connections for a test circuit for testing circuit breakers are shown herewith. A test of this type demonstrates the operation of a circuit breaker as it would be under actual operating conditions. The test as outlined by Mr. Scott is merely a current-rupturing test, not a power-rupturing test. Circuit breakers are installed in actual practice to rupture electrical power, not current.

C. L. KASSON,
Superintendent Standardizing and Testing Department.
Edison Electric Illuminating Company of Boston,
Boston, Mass.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Higher Steam-Pressure Turbines.— A. H. LAW AND J. P. CHITTENDEN.— The theoretical and practical gains arising from the use of higher steam pressures in turbines are reviewed in connection with recent progress. It is stated that improvements in regard to high vacuums have come so close to the realizable maximum that little more can be done in that connection, and it is contended that the present average of 750 deg. F. for steam temperatures constitutes a limit which necessitates considerable investigation before it is safe to exceed it. Regenerative steam heating and reheating between stages involve a fundamental alteration in the steam cycle. Three-stage steam heating which conforms with the usual practice will, it is anticipated, lead to further improvements. The results of several tests made to determine the relations between the various efficiency factors in boiler operation, under test and operating conditions, are included in this paper.— *Electrician (England)*, Nov. 4, 1927.

Characteristics of Modern Stokers.— F. H. DANIELS.—The general characteristics demanded of modern stokers and the way in which these requirements are met by traveling grate and multiple-retort underfeed types are stated. Methods of air control and the use of pre-heated air have been outlined in connection with this subject. The desirability of balancing losses against volume of CO_2 produced in order to arrive at a good operating standard is suggested.— *Mechanical Engineering*, October, 1927.

Generation, Control, Switching and Protection

Switch Position Indicator. — M. SCHLEICHER. — The switchboard on which every switch is indicated by a small red and green lamp so arranged that when any particular breaker is in an open position the green lamp representing it will appear lighted, while a lighted red lamp indicates that this breaker is closed, is a familiar institution. The author maintains that on a large board with a number of such indicator lamps it is frequently difficult for the operator to notice that a breaker has dropped out owing to some trouble, and he suggests a radical change and simplification of this indication method. A combination of the remote-control switch handle with an illuminated glass bar is the basis of the plan. If the position of this handle checks with the position of the switch which it controls, the glass bar will appear lighted, whether the switch is closed or opened. The position of the bar, up and down or crosswise, will indicate the status of the breaker. If, however, unintentional tripping occurs, in which case the position of the handle will not coincide with the switch, the glass bar will appear in unmistakable flickering light until the handle is turned into the open position. *Siemens Zeitschrift*, September, 1927.

Transients Due to Short Circuits.— R. J. WOOD, LLOYD F. HUNT and S. C. GRISCOM.—The authors have dealt with the results indicated in tests conducted on the 220-kv. system of the Southern California Edison Company. The main features of the system are outlined, with such operating data as are necessary to afford an understanding of the various conditions that have to be met. The general scheme of relay production is described, and the causes of flashovers and their times of occurrence are tabulated, together with the percentages of such failures as have resulted in interruptions to service. These interruptions have been found to depend largely upon the load being carried on the lines at the time. With a load less than 150,000 kw. there are no interruptions unless relays are inoperative. A number of typical records of short circuits are shown and analyzed. Large amounts of power appear to be consumed in short circuits, but it is demonstrated that this is dependent upon the ground resistance. Virtually all short circuits are single-phase to ground. The advantage of low-reactance machines is discussed, and the various factors that prevent loss of synchronism are pointed out. The records indicate that there is little tendency on the part of synchronous machines at either end of the line to fall out of step within the group, but that the sending end, under certain conditions, will fail to keep the synchronism with the receiving end.— *Journal of American Institute of Electrical Engineers*, October, 1927.

Units, Measurements and Instruments

Viscosimeter.—D. P. ALBRECHT-WOLFF.—Insulating oil for switches and transformers is specified for a certain degree of viscosity measured in Engler degrees. International bodies have agreed to determine the viscosity by a standard method which, while giving precise results, is difficult and tedious. The authors have developed a viscosimeter which not only reduces the measurement to a matter of ten minutes but has the further advantage of recording the reading and eliminating entirely the human error, as the measurement is made automatically. The sample of oil is run into a small vessel, around which is placed a heating element to permit readings at any desired temperature. A small ball placed at the upper end of a double pendulum is immersed in the oil. The length of the pendulum may be fixed so that the number of its oscillations will be in direct proportion to the viscosity of the tested oil in which its lower part, with the little ball, rocks to and fro. Near the fulcrum of the pendulum is fastened a mirror which reflects a beam of light upon a slowly traveling roll film. Upon development the strokes of oscillations can be counted on the film, and a calibration gives directly the degrees Engler of the tested oil.— *Zeitschrift des Vereines Deutscher Ingenieure*, Sept. 10, 1927.

Transmission, Substations and Distribution

Oil-Switch Problems. — F. KESSELRING.—Since it is impossible to solve mathematically all the various problems of current interruption under oil and to combine them into a complete theory, investigators have been forced to approach the solution by the experimental method. The present author has added materially to the general knowledge of oil-switch problems, having built an experimental switch with a glass oil tank and taken high-speed motion pictures of the rupturing process. The subsequent mathematical evaluation of the obtained films gave a clear understanding of the arc formation, the motion of the oil level, the amount of gas evolution, etc. Since the model switch can be equipped with single-break or multi-break electrodes, or with explosion chambers around the contacts, valuable data were obtained for these contacts. — *Elektrotechnische Zeitschrift*, Sept. 1 and 8, 1927.

First Automatic Rectifier Substation. —The first substation of this type to be installed by the Montreal Tramways Company has recently been placed in service. Power is received at a potential of 12,000 volts, three-phase, and is reduced in potential and transformed to six-phase current before its rectification by means of the mercury-arc apparatus. This station employs four conversion units each rated at 1,000 amp., 600 volts direct current. Two of the rectifiers make up a unit of 1,200-kw. rating. Each rectifier contains six anodes connected to one of the transformer terminals. A single cathode consists of mercury in a receptacle at the bottom of the pot. To insure continuity of the arc, auxiliary units are included for starting the action when the rectifier is switched into circuit. Vacuum pumps maintain the necessary low pressure within the apparatus, and water cooling is utilized for the removal of the excess heat. The considerations which are said to have been taken into account in the selection of this new equipment for the substation are given as higher average over-all

efficiency under all load conditions, cheaper building costs because of absence of any foundation for equipment, low cost of maintenance, simplified control as compared with the apparatus of starting and synchronizing rotary converters or motor-generators, silence of operation and freedom of vibration, and capacity for withstanding high momentary loads. The guaranteed efficiencies of the units measured between the incoming 12,600-volt line and the outgoing direct-current bus, including the transformers and all auxiliaries between these two points, are given as 94 per cent at full load and three-quarters load and 93½ per cent at 25 per cent overload and at half load. Actual operating efficiencies are expected to offer considerable improvement over these figures.—*Electrical News (Canada),* September 15, 1927.

Motors and Control

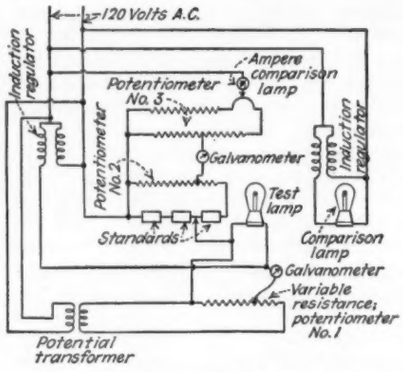
Recent Improvements in Large Induction Motors.—D. F. ALEXANDER.—The development of the large induction motor, like that of many other electrical rotating machines, has been a steady and interesting progression. From the first induction motor to the present product has been a long step, marked by the analytical ability of many capable engineers and accompanied by continual improvements in construction, some of which are reviewed in this paper. The description of the advance in this type of motor from crude beginnings to its present state has necessitated that some trend in development be followed from the beginning, so that not all of the improvements mentioned in the paper can be called recent. The subject of ventilation, insulation, coil design and bracing, collectors, bearings and manufacturing improvements are all considered in relation to this type of motor. It is stated by the author that reliability, simplicity, low first cost and ease of control have enabled the various types of induction motors to outsell their rivals in the power field. This situation may, by good engineering, be continued.—*Journal of American Institute of Electrical Engineers,* November, 1927.

Electrophysics, Electrochemistry and Batteries

Carbon Electrodes.—K. ARNDT.—This article gives a detailed account of the raw materials needed and of the manufacturing process of carbon electrodes, such as are used in electric furnaces, in dry cells and dynamo brushes. Measurements are required to determine suitability of electrodes, electric resistance, microscopic structure, and scleroscope hardness. Special instruments for the latter test have been developed and standardized. Electrodes for arc furnaces must conform to other requirements than those for electrochemical processes. The costs of natural anthracite, carbon electrodes, graphite electrodes and good dynamo brushes are said to be in the ratio of 1 : 10 : 50 : 1,000 per unit weight.—*Zeitschrift des Vereines Deutscher Ingenieure,* Sept. 24, 1927.

Illumination

Photometry and Watt Measurements of Incandescent Lamps on Ordinary Alternating-Current.—C. H. SHARP AND E. D. DOYLE.—A circuit arrangement is presented whereby the lumens and watts or amperes of incandescent lamps may be measured on an ordinary alternating-current circuit. The principle employed is to reduce the measurement, both of lumens and of electrical values to a comparison between the test lamp and a comparison lamp which is affected similarly by all voltage fluctuations. Rheostats are replaced with induction regulators and no indicating instruments are required, the electrical methods being zero methods throughout. The apparatus described in this article was built at the Electrical Testing Laboratories and put in operation about a year ago. Since then it has been in continuous use in routine measurements of incandescent lamps. It has been found that the precision of photometry is on the whole rather greater with this arrangement than with storage batteries and laboratory standard instruments. For practical purposes and under testing laboratory conditions the usual fluctuations in voltage which may be encountered with any reasonably well-regulated alternating-current supply will not interfere with the satisfactory utilization of this apparatus.—*Transactions Illuminating Engineering Society,* 1927.



ALTERNATING-CURRENT CIRCUIT SERVES FOR PHOTOMETRY WORK

Traction

Motor-Generator-Type Locomotives for Great Northern Railway.—ROBERT WALSH.—A technical description of the locomotives used on the recently electrified Great Northern Railway and the results of tests made upon this equipment are given in this article. The locomotives are of the geared motor type and have converting apparatus and cab mounted on a cab underframe, which in turn is supported through two center plates on two trucks. The trucks are articulated, and each truck has three driving axles with an extension of the truck resting on a single-axle radius-bar guiding truck. Single-phase power at 11,000 volts, 25 cycles, is transformed to 2,300 volts. A synchronous motor operating at the lower voltage drives, through a flexible coupling, two direct-current generators which are connected in series and supply current at 1,500 volts potential to the traction motors. The speed of the locomotive is chiefly controlled by varying the voltage of the generators, additional speed being obtained by two field-shunting positions. Other articles in the same publication discuss the nature of the system on which the electrification project was introduced, the sources of power for this undertaking and the design of the air-blast transformers which are used in the locomotives. This issue represents a fairly complete résumé of contemporary practices in railway electrification, although specifically concerned with one company's work, electrification standards and requirements.—*General Electric Review,* October, 1927.

Heat Applications and Material Handling

Industrial Electric Heating.—N. R. STANSEL.—This article constitutes the first of a series and includes primarily a statement of the principles involved in the application of electricity to heating processes. Various mathematical expressions are introduced for the expression of the factors of heat absorption, storage, conduction, convection, radiation and the interrelated values of these quantities. Heat-transfer curves for constant temperatures of a number of different values in the heating chambers, and with the charge and an initial temperature of 40 deg. F., are given in connection with the discussion.—*General Electric Review,* October, 1927.

Miscellaneous

Application of Dimensional Analysis to Centrifugal Fans.—ERNEST M. FERNALD.—The author has endeavored to demonstrate that the commonly accepted practical methods and mathematical determinations of centrifugal fan capacities are considerably at variance with the factors involved in actual conditions. It is stated that geometrically similar fans would be more efficient in the larger sizes and that dimensional analysis affords a satisfactory explanation of the general characteristics of geometrically similar centrifugal fans by showing that the ratios of pressure, power and efficiency are all functions of the two variables determining the gross eddy loss and frictional loss. The efficiency increases with an increase of the frictional loss factor if the eddy loss factor is held at a constant value. The efficiency of a given fan is therefore greater at high speed and the efficiency of similar fans is greater for the larger sizes. Efficiencies are lowered when a fan is handling hot gasses.—*Mechanical Engineering,* September, 1927.

News of the Industry

132-Kv. Cables and Railroad Electrification

These Are Outstanding Topics at Regional Institute Convention in Chicago —Other Papers—Successful Meeting of Students—Record Attendance

THE program of the Great Lakes District regional convention of the American Institute of Electrical Engineers at Chicago, Nov. 28, 29 and 30, was characterized by a number of subjects of exceptional interest. Chief among these were 132-kv. cable and railroad electrification. The first topic was taken up in a symposium on Tuesday morning and included four papers: "Economics and Commercial Demand," by Philip Torchio, which was read in Mr. Torchio's absence by A. H. Kehoe; "Theory, Design and Development," by L. Emanueli; "Manufacture, Inspection and Testing," by Wallace S. Clark, and "Installation," by A. H. Kehoe. Discussion on these papers was led by H. W. Eales, chairman of the session, and included a description and motion pictures of the Chicago installation by D. W. Roper and discussion by others.

The second topic—railroad electrification—was taken up in the Tuesday afternoon session, presided over by Bion J. Arnold. Operating experience during the first year of Illinois Central electric operation was presented by W. M. Vandersluis. The storage-battery locomotive for yard use was described in a summarization of experience and performance of a 125-ton machine of this type in the Chicago yards in a paper by Edward Taylor. Mercury-arc rectifiers as applied to railroad supply were discussed by Cæsar Antoniono in a paper dealing with the results of the application of a 1,000 kw., 600-volt rectifier to automatic operation in interurban railway service. This session was closed with a paper on the broadening field of the application of synchronous motors, particularly in steel mills, by W. T. Berkshire.

Wednesday morning's session was presided over by H. B. Gear and was devoted to power systems. A very interesting paper presented by E. C. Williams outlined the important features of major stations and transmission and distribution systems of the Chicago region and gave a forecast of the future development of electricity supply in that territory. An explanation of the contract arrangements for power interchange among the three largest companies in the area was included. The Hall high-speed recorder, a new form of oscillograph for recording fault currents and their voltage-disturbing effects, was described by E. M. Tingley in a paper read by C. I. Hall. Representative records were analyzed and further applications of the instrument were suggested.

L. N. Crichton and H. E. Graves presented a discussion covering many of the new methods for relay protection required by modern large-system interconnections. Some of the new relays that have been invented for this exacting service and the improvements on older types were described and a typical relay installation for a 220-kv. interconnection was illustrated.

The conclusion that improvement in design of alternators must follow the comparatively recent appreciation of generator instability in interconnected systems was reached in the paper by J. F. H. Douglass and E. W. Kane. A method of testing synchronous machines in the unstable as well as the stable range was described.

The afternoon session, under the chairmanship of H. L. Hope, was concerned with communication. A description of the production of telephone cable on a large scale and of the recent advances in the art was given by C. D. Hart. Burke Smith and G. B. West presented a paper on the growth of the telephone toll business in the Chicago region and the engineering and operating problems involved. A vacuum-tube voltmeter capable of measuring alternating voltages over a wide range of frequencies was described by C. M. Jansky, and an oscillographic study of the operation of vacuum-tube rectifiers with various filter arrangements was presented by J. H. Kuhlmann and J. P. Barton.

The first day of the meeting was given over to a student convention which was exceptionally successful. The student registration was about 250, representative of virtually all colleges in the Great Lakes district. The character of papers presented was high and, as a whole, the general tone of this meeting amply augured the success of Institute activities in the colleges. The total attendance at the convention was 900, a record for regional conventions, and about two-thirds of these attended the dinner-dance on Tuesday night, at which President Gherardi and B. G. Jamieson spoke.

Admiral Bullard, Head of Radio Commission, Dies

REAR-ADMIRAL W. H. G. BULLARD

BY THE sudden death from heart trouble at Washington on Thanksgiving Day of Rear-Admiral William H. G. Bullard the Federal Radio Commission has been deprived of its head. Admiral Bullard was made chairman of the commission by President Coolidge last March, when the body was organized, and had since then worked indefatigably in its task of regulation and adjustment. He was born in Media, Pa., in 1866, was graduated from the United States Naval Academy twenty years later, and until 1922, when he retired, he served with the navy either at sea or on shore duty.

He was a student of electricity and in his early years wrote the "Naval Electrician's Textbook." On the discovery of wireless means of communication he turned with enthusiasm to the new art and from 1900 to 1912 was a leader in the radio work of the navy, becoming in the latter year the first superintendent of naval radio service. He held this post until 1916, and later, from 1919 to 1922, after war service, he was director of naval communications. He organized the department of electricity at the Naval Academy and was head of the department from 1912 to 1916. Besides this he compiled a "Handbook of Regulations for the United States Naval Radio Service." Admiral Bullard's selection to head the Federal Radio Commission was universally applauded.

Although but eight months old, only two of the five original members of the commission remain—O. H. Caldwell of New York and Judge E. O. Sykes of Mississippi. John F. Dillon of California died in September and was succeeded by H. A. Lafount of Utah. Henry A. Bellows of Minnesota resigned a short time ago, and the President appointed Samuel Pickard of Kansas in his place.

Re-enter Muscle Shoals and Boulder Dam

National Stage Set for Old Favorites—Few Votes Seen for Out-and-Out Ownership of Former—Confusion Over Latter—Industry Not to Oppose Walsh

By Paul Wooton
Washington Correspondent of the Electrical World

OPPOSITION to the Muscle Shoals resolution of Senator Norris will be more determined at this session of Congress, it is believed, than would have been the case had it reached the floor of the Senate at the last session. The discussion of the Walsh resolution has revealed that while there is only a handful of votes which could be counted upon to support any out-and-out public ownership proposition, some additional votes could be mustered for the Norris resolution as it carries with it a plan for the experimental production of nitrate fertilizer.

Senator Norris expects to reintroduce the resolution which he presented at the last session. There will be no alteration, with the exception of a reduction in the amount authorized for the construction of fertilizer plants. The new resolution will suggest that $2,000,000 be used for that purpose which will be repaid to the treasury from the sale of power. As Senator Norris believes fertilizer can be produced to better advantage at points other than Muscle Shoals, the resolution provides that the fertilizer plants may be located anywhere in the United States. The fact that the Norris resolution authorizes the construction of transmission lines "within transmission distance in any direction" from Muscle Shoals will be seen as the entering wedge for the operation of the Wilson Dam by the government. If the Norris resolution is adopted, the expectation in Washington is that that feature will be eliminated.

Hearings on the Swing-Johnson Boulder Dam bill, which were to begin immediately on the convening of Congress, may not get under way until about the first of the year, it is stated at the office of the committee of the House of Representatives on irrigation and reclamation. The situation may have been influenced by the inability of the governors of the states in the Colorado River basin to reassemble in Denver on Dec. 5, as had been planned. Conferences are in progress between the governors of the lower three states. Governor Emerson of Wyoming, who is in Washington, thinks no general conference of the governors will be held until the result of the negotiations among the lower states is known. Secretary Work's advisers on the Colorado River are meeting in Washington, but expect to make no announcement at this time. The advisers are to submit individual reports. One of them has his report virtually completed, but the others still have considerable work to do before they will be ready to submit their findings.

The electrical industry will interpose no objection to the investigation demanded by Senator Walsh of Montana, according to all indications observed by the Electrical World's representative in Washington, and, as it is customary for the Senate to pass resolutions calling for investigations, it seems probable that Senator Walsh's proposal will be adopted without a fight. It is recognized that the investigation is likely to result in heavy losses to small investors and that powerful financial interests may profit at their expense, but it is believed that these losses will be less if the investigation goes forward at this time. To have it hanging over the securities of the industry for an indefinite period would be worse in the long run, it is believed. By going forward at this time the industry soon will be able to show that the charges being made are unfounded or at most substantiated only in isolated instances.

Apparently the industry is making no claim that all within its ranks are 100 per cent pure. It is believed, however, that the inevitable percentage of the unscrupulous is as small as in banking, mining or any other business. There is fear that all the emphasis is going to be put on any delinquencies that may be unearthed and that efforts will be made to create the impression that some practices applying to an insignificant percentage of those engaged in the business are general throughout the industry. Despite any effort that may be made to make political capital out of the investigation, the prevailing impression in Washington is that the industry will be able to convince the public that fair dealing is the rule and dishonesty the exception.

Pinchot Tells of Trust With Five Heads

General Electric, Doherty, Morgan, Ryan and Insull Control More than Half of Energy Produced in Nation, He Says to Senator Walsh

WITH characteristic positiveness, Gifford Pinchot, former Governor of Pennsylvania, has rushed to the support of Senator Thomas J. Walsh in the latter's proposed investigation of the light and power industry and the alleged concentration in its control. Mr. Pinchot has just released, as of Dec. 2, an open letter to Mr. Walsh in which he offers "to submit facts which I believe furnish definite proof of the existence, ownership and extent of this concentration, together with material on methods of financing stock inflation and the exploitation of the electric monopoly."

After repeating remarks made by himself three years ago in laying before the Pennsylvania Legislature his "Giant Power" plan, Mr. Pinchot says:

During the past year a study of this question has been carried on under my direction by an expert in whose ability and integrity I have full confidence. His report definitely establishes the truth of what I said. It shows that the coming nation-wide electric monopoly is very much further advanced than the propaganda of the electric interests has permitted the public to surmise. The study is not fully completed, but it has gone far enough to establish these facts:

Forty-one corporations control four-fifths of all the electrical energy produced in the United States. Out of the 68,732,000,000 kw.-hr. of electricity produced in 1926, these forty-one corporations produced 54,713,000,000.

These forty-one corporations have a total capitalization of ten thousand two hundred million dollars. They monopolize all the sources of electric power for four-fifths of our people. Eighty-five million seven hundred thousand Americans must get electricity from these forty-one corporations or go without.

Of these forty-one corporations twenty-nine, or about three-quarters, are already known to be dominated, owned or controlled by five men or corporations and their associates. These five dominant electrical interests are the General Electric Company of New York, Doherty of New York, Morgan of New York, Ryan of New York and Insull of Chicago. It is altogether probable that most, if not all, of the remaining twelve also will be found to be dominated, owned or controlled in the same way. But if the five major interests do in fact control only the twenty-nine corporations, still their assets are capitalized at six thousand million dollars ($5,990,000,000), and they produced in 1926 more than half of all the electricity used in the United States.

The five controlling interests are allied, but not so far as we know actually under any single head. But they are tied together, first, by their common interest in maintaining their present power to collect extortionate rates from their customers. The combined electric lobby now in Washington, which represents them all, is proof enough of that. Secondly, they are tied together by common ownership in certain companies, by common investment interests, by common directors and doubtless in many other ways which are not yet disclosed.

These facts are evidence of the prodigiously rapid growth of a nation-wide electric monopoly, and they justify abundantly such warnings as are quoted above. Their significance to our people not only economically and industrially, but politically also, is almost beyond exaggeration. They have a direct and most important bearing on the overshadowing issue in America, which is the control of government by monopolists for the purposes of monopoly. In this attack on self-government and economic freedom the electric interests form the head of the spear. It is of the most urgent importance that this fact should be understood.

Ohio's Help Sought in Walsh's Utility Probe

Co-operation of the Public Utilities Commission of Ohio in an investigation into the general subject of public utilities, particularly their financing, should such an investigation be ordered at the coming session of Congress, was asked on Nov. 26 by United States Senator Thomas J. Walsh of Montana in a letter to the Ohio commission. In this letter Senator Walsh alludes to the establishment in Washington of an office by the Joint Committee of National Utility Associations. Saying that the tendency in the past few years toward centralization has been intense, the Senator adds: "In some instances excessive prices have been paid for properties of independent companies and securities issued against them in amounts considerably in excess of their real value. The public is not organized to meet this situation," he continues, "and I earnestly ask your help and suggestions in the investigation, should it be called to meet properly the needs of the public."

Presumably, similar requests for aid have been sent by Senator Walsh to other state commissions.

Radiotelegraph Sessions Are Concluded

Secretary Hoover Addresses Final Plenary Meeting, Calling the Accomplishments of the Delegates a Milestone in International Relations

ASSEMBLING for their final plenary session at Washington on Friday, Nov. 25, the delegates from eighty governments to the International Radiotelegraph Conference, who had been in session in that city for seven weeks, listened to an address from Secretary of Commerce Hoover, the president of the conference, who, pointing out that the meeting was the largest international conference in history, said its arrival at unanimous conclusions upon such a highly technical and difficult problem was in itself both a sign of the progressive capacity of the world to solve international problems and a tribute to the character and spirit of the delegations.

The treaty as adopted contains 60 provisions, founded upon 150 committee reports involving a knowledge of electrical physics. Discarding any idea of dividing available channels of wireless communication among the different nations, the basic solution was found by dividing the channels into groups, each group being used for a particular variety in communication. "Kilocycle" has been adopted as a major designation rather than "wave length." Channels from 100 to 500 kilocycles have been set aside primarily for ship-to-shore and aircraft service; the channels from 500 to 1,500 kilocycles have been set aside for broadcasting, and the very great number of channels from 1,500 to 5,000 kilocycles have been apportioned into 40 different bands and divided between four or five varieties of service.

The broadcasting band has been clarified and defined for the whole world in such a fashion that there will be less conflict and interference. The point-to-point radiotelegraph services, mostly land stations, have been likewise clarified and defined to permit constantly extended use in the commercial world. The area of higher kilocycles—that is, the shorter wave lengths—has been so divided as to give stimulation to the many applications which are now tentatively before the world. New spark sets are not to be installed twelve months after the adoption of the treaty, and those then in existence will be replaced within a definite period. Certain definite wave lengths have been conferred upon the amateur, thus recognizing these enthusiasts—largely boys—as an important element in the art.

Numerous incidental problems were worked out in the conference. Among them are the provisions by which messages from the sea shall be transmitted through ships of other nationalities and through land service to their destinations. The agreement has been developed in such a manner that in countries where radio communications are conducted by private enterprise these agencies themselves will establish rules on all questions naturally their own province. Provisions are made for the exchange of regular information between nations as to the establishment and operation of radio stations. Further provisions assure the secrecy of radio messages and arbitration of disputes.

The next International Radiotelegraph Conference will be held in Madrid five years hence.

Problems Canvassed by Radio Division, N.E.M.A.

A penetrating study of the merchandising and sales problems of the radio industry was made at the midwinter meeting of the Radio Division of the National Electrical Manufacturers' Association at Edgewater Beach Hotel, Chicago, on Monday, Tuesday and Wednesday of this week, in a "business clinic" under the direction of George Scoville and D. S. Spencer.

At a general meeting of the entire Radio Division it was recommended that American broadcast channels be consecutively numbered starting with 55 for the 550-kilocycle channel and ending with 150 for the 1,500-kilocycle channel. Misleading magazine and newspaper advertisements and articles were ridiculed by L. A. Hazeltine of the Hazeltine Corporation in an address on "Your Money's Worth in Radio." Dr. Alfred N. Goldsmith, National Broadcasting Company, discussed broadcasting from the engineer's viewpoint. The legislative committee of the Radio Division recommended that radio receivers should not be licensed by federal, state or municipal authorities.

The problems and difficulties of the Federal Radio Commission were explained to the radio manufacturers at their banquet by Commissioner Caldwell.

Electricity Plays Part in Hoover's Report

Secretary of Commerce and His Assistants Touch on Its Importance in the Story of Industrial Growth and Widespread Prosperity

DEALING with "Progress in National Efficiency," his remarks forming part of the annual report of Secretary of Commerce Hoover, just made public, E. Dana Durand, chief of the Division of Statistical Research, Bureau of Foreign and Domestic Commerce, observes:

One of the most profound modern tendencies is the swiftly expanding use of electric current both in the household and in industry. We are adding 10 or 12 per cent to the output of electricity every year. Approximately two-thirds of our factory machinery is now operated by electric motors as compared with 15 per cent twenty years ago. The electric stations are rapidly advancing in technical efficiency. The amount of fuel converted to coal units burned in fuel-using electric plants has fallen from about 3.2 lb. per kilowatt-hour in 1919 to about 1.9 lb. in 1927. There is little doubt that three times as much energy is obtained from a given quantity of fuel at the present time as fifteen or twenty years ago.

The United States, Mr. Durand says, now consumes in fuel and water power the equipment of from 7 tons to 8 tons of coal per capita annually, as against less than 5 tons in 1901.

Mr. Hoover, in his own part of the report, says that this expansion in the use of electrical energy represents both displacement of other sources of light, heat and power and an advance in living standards and in the activity of industry. In a table of "major economic indexes" electric power production is ranked at 198 in 1927 as compared with 179 in 1926 and 112 in 1922. This represents volume of business in quantities, not value, and compares with the following figures for the five-year period: Manufacturing, production, 129 and 89; mineral production, 149 and 91; forest products, 114 and 98; railroad freight (ton-miles), 125 and 89; building contracts let (square feet), 132 and 92.

Under another heading foreign trade is treated at length by Julius Klein, director of the Bureau of Foreign and Domestic Commerce, and Mr. Durand. "Elimination of Waste" forms another division of the report, and under "Increase of Standards of Living" W. M. Steuart, director of the census, and the late Reuben B. Sleight, assistant to the Secretary, include figures showing that from 1919 to 1926 the value of electric household appliance manufactures rose from 37 cents to 55 cents per capita; electric refrigerators sold increased in number from an insignificant fraction to 2.1 per 1,000 population; farms receiving electric service from 30 to 56 per 1,000; residential electric customers from 76 to 135 per 1,000 population, and electric customers of all classes from 94 to 166. Figures for energy production are also given.

Pacific Coast Commercial Committees' Work

Commercial Men Are Told of Their Shortcomings and Opportunities at General Meeting in San Francisco

"SALES problems of the light and power industry are unique only because of the attitude of commercial men toward them," declared Richard Neustadt, managing director of the San Francisco Retail Merchants' Association, in addressing 150 men of the electrical industry gathered at San Francisco Nov. 17-18 for the second yearly conclave of the Commercial Section of the Pacific Coast Electrical Association. The attitude of mind of the electrical industry toward its sales problems, which are essentially not different from the sales problems of other industries, has been one of the greatest barriers impeding progress toward proper electrification of the home, the speaker said, declaring that "no one is selling electrical appliances." The trouble has been that power companies merchandise on the basis that the public should buy electrical appliances simply because the power company wants to sell kilowatt-hours. The only way the home can properly be electrified, in the opinion of Mr. Neustadt, is to tell the public the story of the service.

Lewis A. McArthur, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., told what had been accomplished by his company in getting company executives and employees to "practice what you preach." He said that 76 per cent of the employees of his company who maintain homes use electrical ranges and that the average annual consumption of all employees who maintain homes is 1,400 kw.-hr. per year. The part which wives of employees can play in public relations and sales was stressed.

The necessity for "selling" the industry on its own story was emphasized by W. L. Frost, president of the Pacific Coast Electrical Association, in addressing the conclave at its opening session.

All committees reported progress on a constructive year's work. The lighting committee has its speaking program under way and is giving two talks per day with fifteen speakers before women's clubs and parent teachers' associations on conservation of vision. A study is being made of street-lighting campaigns, and demonstrations are being conducted in several cities of California to show the benefits of better store and window lighting. Data are being gathered by the competitive power committee to combat isolated plants, and a concerted effort is being made to bring about more complete electrification of oil fields. The industrial heating committee has prepared illustrated lectures on industrial heating and is gathering cost data on existing installations to include in a handbook previously prepared.

The merchandising committee is concentrating its efforts on improved trades relations and has delegated a sub-committee to confer with representatives of all retail appliance outlets. Real progress has been made by the range committee toward reducing the cost of range wiring. A set of range wiring specifications has been drawn up which meet the requirements of the Fire Underwriters' code and which will reduce wiring cost within incorporated cities and towns to a maximum of $50. The Electragists' association and city inspectors of California have pledged their support to a modification of requirements which will make this possible. Another program to be carried out by the range committee is an employee range campaign in February.

N.E.L.A. Headquarters to Be Moved Dec. 19

Announcement was made on Monday of this week that after Dec. 19 the address of the headquarters office of the National Electric Light Association will be 420 Lexington Avenue, New York, instead of 29 West Thirty-ninth Street. The change in location will be made in order to house on one floor all headquarters departments and activities, in the interest of economic administration.

Southern California Edison's New-Business Budget

More than one-half of the Southern California Edison Company's 1928 budget of $31,850,000 has been set aside for the construction of new distribution lines and substations and the development of new business, according to R. H. Ballard, vice-president and general manager of the company. A sum of $16,950,000 has been set aside for this work. Of the balance, $5,712,000 is to be expended at the Long Beach steam plant, where the first of eight new 93,750-kw. units will be completed. On the hydro-electric construction work in the High Sierras $5,892,000 will be expended.

"The spending of a large portion of the budget for new-business activities marks a new era in the history of the Southern California Edison Company," said Mr. Ballard. "Heretofore, the work of developing new sources of electrical energy, both hydro and steam power, has required the major portion of the budget. We have finally reached the point in our construction history where we are able to bring on to our lines large blocks of power at very short notice. On our Big Creek-San Joaquin River project the long preliminary period which has been necessary before a potential hydro-electric site could become an actual generating site is over, and we are now in a position to build generating plants virtually as needed.

"In the steam generating field great strides have been made in the past seven or eight years, which enable us to add large new units in from six to eight months' time. All of our attention for the next few years must be concentrated upon the problem of developing new demands for the energy which we have ready for use. More than 99 per cent of all of the people living in the territory served by our company are today users of electricity. Our task is, therefore, not to find new customers, but to demonstrate to our present customers that they can profitably take advantage of electric service to a far greater extent than at present. As evidence of the scope of our progress, we intend to market five thousand electric ranges during the coming year."

Upholds Lake Diversion

Special Master Hughes Sustains Right of Chicago Sanitary District to Use Water Under Existing Permit—Controversy Now for Congress

HANDING down a decision rendered by him as special master for the United States Supreme Court in suits brought by states which border the Great Lakes (including New York, Pennsylvania, Ohio, Michigan, Wisconsin and Minnesota) against the Chicago Sanitary District and the State of Illinois, with six lower Mississippi River states as interveners, Charles E. Hughes last week recommended their dismissal and sustained the right of Chicago to divert water through the drainage canal under permit of the Secretary of War as authorized by Congress. He finds, however, that the complainants are approximately correct in their estimate that the lake levels are lowered from five to six inches by the diversion. Mr. Hughes' conclusions have a direct bearing on hydro-electric development especially in the Niagara and St. Lawrence territory and on international negotiations concerning these rivers, the Dominion of Canada as well as the states named having protested against the diversion. He summarizes his findings in six paragraphs, as follows:

1. That the complainants present a justiciable controversy.
2. That the State of Illinois and the Sanitary District of Chicago have no authority to make or continue the diversion in question without the consent of the United States.
3. That Congress has power to regulate the diversion; that is, to determine whether and to what extent it should be permitted.
4. That Congress has not directly authorized the diversion in question.
5. That Congress has conferred authority upon the Secretary of War to regulate the diversion, provided he acts in reasonable relation to the purpose of his delegated authority and not arbitrarily.
6. That the permit of March 3, 1925, is valid and effective according to its terms, the entire control of the diversion remaining with Congress.

Thus, while Chicago wins a victory for the "status quo," Mr. Hughes' findings appear to sustain the lake interests to the extent of giving them grounds on which to base action should Chicago attempt a diversion of lake water above the amounts authorized by official permit. The decision also leaves Congress free to pass such legislation affecting diversion as it may see fit.

Standard Gas & Electric Adding 270,000 Kw.

Byllesby Official Compiles List of New Generating Equipment Ready or Nearly Ready in Plants of Company in Six States

CONSTRUCTION work of subsidiary and affiliated companies of the Standard Gas & Electric Company now under way or authorized for immediate installation will add a total of more than 270,000 kw. to the generating resources of these companies, according to H. W. Fuller, vice-president of the Byllesby Engineering & Management Corporation. Upon completion of the work described, the combined generating facilities of companies in the Standard system will total more than 1,340,000 kw. The additions and improvements, most of which have already been noticed in the ELECTRICAL WORLD, are as follows:

The Duquesne Light Company of Pittsburgh, which last summer completed the installation of one 40,000-kw. turbine unit in its Colfax station, has now a second unit of the same size ready, bringing the capacity of Colfax to 260,000 kw. A new "isolated-segregated" switch house has been erected on Brunot Island, adjacent to the steam plant, and is almost complete.

At Louisville the Louisville Hydro-Electric Company is completing the construction of the hydro-electric plant at the Falls of the Ohio River, and the equipment is being tested. This plant is rated at 100,000 hp.

The first 20,000-hp. unit of the 60,000-hp. Prospect No. 2 development of the California-Oregon Power Company, under construction on the North Fork of the Rogue River, in Oregon, is ready for service, and a second unit of the same capacity will be completed shortly after the first of the year.

An additional turbine unit of 30,000 kw. rating, with two additional boilers, is being installed by the Oklahoma Gas & Electric Company in an extension to its Harrah steam-electric station, making its total capacity 65,000 kw.

The San Diego (Cal.) Consolidated Gas & Electric Company is to install a new 25,000-kw. steam turbine unit at Station B, and space is being provided for another unit of the same size.

Favorable progress on the construction of the 27,000-hp. hydro-electric station of the Northern States Power Company at Chippewa Falls on the Chippewa River in Wisconsin is reported. This plant is planned for completion by September, 1928, and will operate synchronously with the 40,000-hp. Wissota hydro-electric station, 3 miles above. The Northern States has just completed improvements to its steam electric station at Fargo, N. D., replacing the steam ends of two 1,500-kw. turbine units with new equipment, thereby increasing their capacity to 2,250 kw. each. Authorization also has been granted for the installation of additional generating capacity at Grand Forks and Minot, N. D.

Plans have been approved for the construction of the 84-mile, 110-kv. transmission line from Green Bay to Stevens Point, Wis., which will interconnect the systems of the Wisconsin Public Service Corporation and the Wisconsin Valley Electric Company. This line will be of H-frame wood-pole construction.

San Francisco Collector Was Misunderstood

Widely printed news dispatches stating that Collector of Internal Revenue McLaughlin of San Francisco proposed to tax the income of all San Francisco municipal utilities were entirely in error and unauthorized, Mr. McLaughlin told a representative of the ELECTRICAL WORLD a few days ago. The whole discussion, Mr. McLaughlin's attitude in which was wrongly interpreted in the ELECTRICAL WORLD last week, came about as the result of two actions by the collector: First, the collection of the government bus license on city-operated buses, now long overdue; second, the forwarding to Washington of a copy of the contract between the city and the Pacific Gas & Electric Company covering the sale of the city's Hetch Hetchy power to the private company. The latter action was taken because there is some doubt as to whether the city of San Francisco is acting in the capacity of a municipal utility or in a proprietary capacity in selling the entire output of its municipal plant to a private corporation. The department in Washington is expected to hand down a decision within a few weeks.

Singleton Wants Public Attorney in Every Rate Case

A recommendation that the Indiana Legislature enact a law at its next session requiring an attorney to represent the public at all rate cases brought before the Indiana Public Service Commission has been made by Frank T. Singleton, chairman of the commission. The recommendation is the result of a recent appeal to the Circuit Court in Indianapolis in a merger case. The Legislature this year passed a law whereby either utility companies or the public might appeal to circuit courts against decisions adverse to them. In the Indianapolis case referred to, the first to be tried since the passage of the law, the court criticised the commission for not presenting its side of the case. It was unrepresented. A survey of the statutes shows, according to the Indiana Attorney-General, that the commission had no legal right in court, since there was no contest on the part of the public.

According to Mr. Singleton, many rate hearings are "one-sided" and the people are represented only when they become indignant. With such a law as he advocates, Mr. Singleton points out that in cases of appeal from the ruling of the commission the attorney named to represent the public at the hearings before that body would also automatically represent the public, and in a way the commission, before the court.

Purchases and Mergers

Insull Interests Take Control of Western United Gas & Electric Company, with Plants in Northern and Southern Illinois

INSULL, SON & COMPANY have acquired a preponderating interest in the Western United Gas & Electric Company, control of which passed from the hands of former Congressman Ira C. Copley to A. E. Fitkin & Company and the banking firm of E. H. Rollins & Sons early last year and was afterward vested in the Rollins firm alone. No details of price have been made public, but it is said that Colonel Copley will retire as president though retaining holdings of preferred stock. The Western United Gas & Electric has headquarters at Aurora, Ill., and serves that community and Elgin, Wheaton, Glen Ellyn, Murphysboro (in the southern end of the state) and other municipalities with electric light and power, as well as supplying these and other places, including Joliet, with gas. A glance at the map of Illinois shows that the company's properties in the Fox River district about 30 miles west from Chicago formed a sort of wedge driven into what might be regarded as logically Insull territory. The Western United companies, which were formerly under the executive management of Stone & Webster, included the Aurora, Elgin & Fox River Electric Company, doing a traction as well as a light and power business. Originally the Western United was a home-owned corporation, 80 per cent of its stock being held by residents of Aurora. Its present capitalization is put at $32,000,000.

A tentative proposal has been made by the Northern Indiana Public Service Company to the Hobart (Ind.) City Council to take over the municipal lighting and power system and also to solve a water-supply problem for the city. The sum to be paid by the company would be more than $100,000, it is said, exact figures to be set by the Indiana Public Service Commission.

Application is pending before the Pennsylvania Public Service Commission for approval of the sale of the Ralston Water & Water Power Company to the Northern Pennsylvania Power Company.

Peck Brothers, operating an electric light and power plant in Shushan, Washington County, N. Y., have made application to the Public Service Commission for permission to sell it to the Plattsburg Gas & Electric Company. Harlow E. Ralph, operating an electric power and lighting system in Belleville, Jefferson County, N. Y., has asked authority to transfer his plant to the Woodville Electric Light & Power Company for $8,000.

The Public Service Commission of New Hampshire has approved of the sale of electric properties in Hill by Arthur S. Dewing to the Hill Light & Power Company. The Hill plant serves also sections of Sanbornton and Franklin. Its property is valued at $25,000.

The city lighting plant of Trezevant, Tenn., has been sold to the Kentucky-Tennessee Light & Power Company for $16,000.

The General Power & Light Company, Chicago, is reported to be negotiating for the Yazoo City (Miss.) municipal light plant.

Canada Still Discussing River Jurisdiction

Premiers of Ontario and Quebec Get Together—Lawyers Back Provincial View on Controversy with Ottawa—St. Lawrence Control Also Agitated

A CLEAR statement of the positions of the Provinces of Quebec and Ontario in regard to water-power development was made at the long-contemplated conference of provincial premiers, which was held at Ottawa during the week of Nov. 5. Premiers Taschereau of Quebec and Ferguson of Ontario urged an early decision on the question of the respective rights of the federal and provincial governments in the matter of water power in navigable and interprovincial streams.

Premier Taschereau said it had always been understood that the beds and shores of large streams belonged to the provinces. He thought that this had been firmly decided in the fisheries case which attracted so much attention some years ago, but the question was still open. He thought it was a pity that after sixty years of confederation this question had not been decided. As far as Quebec and Ontario were concerned, the view was very strongly held that the water powers on the St. Lawrence and Ottawa Rivers are the property of the provinces. Mr. Taschereau thought it was a real pity that all the available powers should be allowed to go to waste simply because the federal government continued to oppose the contention of the provinces.

Premier Ferguson declared that if the federal government was prepared to refer the matter to the courts the whole question might be settled in a very short time. Ernest Lapointe, federal Minister of Justice, replied that in view of the magnitude of the issue, it would require further consideration by the Cabinet. It is understood, however, that the matter will be referred to the courts. The most important phase now is a decision as to the form of reference so that no part of the issue will be omitted.

The hands of the Province of Ontario have been considerably strengthened in the St. Lawrence and Ottawa River power development controversy by expert legal opinion which upholds the province's exclusive rights on navigable streams. The signatories to the legal document are Eugene Lafleur, Aimé Geoffrion and W. N. Tilley, three eminent lawyers whose opinions were solicited in anticipation of further difficulties with the federal authorities over the question of jurisdiction.

This legal opinion furnishes ground upon which Ontario and Quebec are prepared to do battle with the federal government before the Privy Council in England, according to Premier Ferguson of Ontario. The two provinces are preparing particularly to combat the authority of the Dominion government to deal with certain phases of the power rights at Carillon, on the Ottawa River.

At the sixteenth annual meeting of the Associated Boards of Trade and Chambers of Commerce of Ontario, held at Kitchener on Nov. 10, a sharp discussion occurred between the delegates on the question of making recommendations to the federal government regarding the St. Lawrence waterway development. While, with a few exceptions, the delegates declared themselves in favor of the general plan of power and ship channel development on the St. Lawrence, there was a large group which insisted that any recommendations going from the convention should urge the necessity of Canadian control of any part of the development within Canadian territory.

Following long discussion, a resolution introduced by the Toronto Board of Trade, which, without provisions, urged the Dominion government to "proceed without unnecessary delay to make appropriate arrangements for the early construction of the enlarged St. Lawrence waterway and for the development of hydro-electric power from the St. Lawrence River between Lake Ontario and Montreal," carried by a slim majority.

Twenty-five Experimental Electrified Texas Farms

In furtherance of the campaign by Texas power companies to extend the use of electrical energy to various kinds of agricultural operations, and in co-operation with the State Agricultural and Mechanical College, 25 experimental electrified farms are to be established in the state. To this end a committee representing the power companies and the educational institution has made a survey of several hundred farms in various sections. Of those selected eight will be devoted to growing cotton, five to dairying, five to poultry raising, two to growing garden produce, two to raising grain and three to general farming.

Among the information sought are the most desirable size of transformer for farm service, the best type of refrigerator for Texas farms, whether present electric ranges are suitable for farm use, the amount of kilowatt-hours used by various electrical equipment on the farm, the maximum demand per farm and the line efficiency. The farms are to be marked by signs to inform the public of what is being attempted, and the experimental work is to be carried on by the agricultural engineering department of the college in co-operation with the engineering and agricultural experiment station and the committee on rural electrification. The power companies are to make all installations of instruments and to detail a man to make readings. It is estimated that three years will be necessary to complete the experiments. An economic study of rural electrification to determine what percentage of their income present users are spending for electricity and the maximum amount to be expected from Texas farms of various types also is to be undertaken if the funds can be obtained.

Briefer News

MILLION-DOLLAR PROGRAM FOR LARAMIE, WYO.—M. H. Soule, superintendent of the Laramie (Wyo.) plant, which is owned and operated by the Western Public Service Company, announces a five-year program of expansion and improvement involving a million dollars, of which $662,000 is to be spent before 1929. The company has just obtained a 25-year franchise from the city of Laramie.

COMPETITION IN NORTH DAKOTA.—Relying on a law passed last winter to enlarge its powers, the North Dakota Board of Railroad Commissioners has, pending a hearing, ordered M. A. Erickson to halt construction of a power plant at Kenmare, where the Village Council granted him a franchise although the place is already served by the Montana-Dakota Power Company. The district court has, however, denied an application to enjoin Erickson and the case has been appealed to the State Supreme Court, where the commission's jurisdiction will, it is presumed, be either established or denied.

ANOTHER OBSTRUCTIVE SUIT AGAINST CONOWINGO SYSTEM.—A suit to block the erection of transmission lines from the Conowingo hydro-electric plant through Tredyffrin Township, Chester County, Pa., has been begun by B. G. and E. R. Levin, owners of land adjacent to the right-of-way, who claim that their property will be injured if the lines are erected. Motion for an injunction against the Philadelphia Electric Power Company was heard at Philadelphia on Dec. 1. A suit brought by James C. Colgate of New York to prevent the company from taking land owned by him was dismissed several weeks ago.

SOUTHEASTERN N.E.L.A. MEMBERS GATHER AT ATLANTA.—Approximately 150 representatives of the electrical industry attended a three-day meeting of executive committees and the Accounting, Commercial, and Public Relations Sections of the Southeastern Division of the National Electric Light Association last week at Atlanta. W. E. Mitchell, vice-president and general manager of the Georgia Power Company; C. A. Collier, vice-president and sales manager of the Georgia Power Company, and A. B. Collins of the Alabama Power Company were among those who addressed the meetings. Two dinners were held, one by the Engineering Section and one by the Commercial Section.

RUCKER WITHDRAWS HIS CHARGES AGAINST HARLEY L. CLARKE.—Exoneration of Harley L. Clarke, Chicago utility operator and promoter of the merger of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company into the Indianapolis Power & Light Company, from the

charge that he was a contributor to an alleged campaign contribution of $19,000 to Governor Ed Jackson in 1924 is contained in a statement of retraction made in the United States District Court at Indianapolis by Alvah J. Rucker, former Corporation Counsel of Indianapolis. A libel suit against Rucker, brought by Mr. Clarke, seeking damages of $250,000, was pending in the court. Dismissal of the libel action followed the retraction.

CINCINNATI COMPANY WILL CONTEST NEW RATES SET BY CITY COUNCIL.—The Union Gas & Electric Company of Cincinnati has filed a suit in the United States District Court to enjoin permanently the enforcement of the rates embodied in an ordinance of the City Council and referred to in the ELECTRICAL WORLD for Oct. 29 (page 904). The company contends that these rates, designed to reduce its earnings by $750,000, are confiscatory and would reduce its rate of return to not more than 4½ per cent.

WISCONSIN POWER & LIGHT COMPANY BUYS HISTORIC DAM.—The Wisconsin Power & Light Company has purchased a historic dam site on the Embarrass River in the village of Embarrass, Wis. The old dam dates back to the days before the Civil War, having been built by Mark Palmer, a pioneer miller, in 1857. With the purchase of the site by the company, a hydro-electric plant will be built to furnish electricity to Embarrass and the surrounding communities.

RURAL EXPERIMENT IN MISSISSIPPI.—Lowndes County, Miss., will be the site of an early experiment by which fourteen farmers will be supplied with electricity over a line 15 miles in length. For the first time in Mississippi electricity will be employed in the dairying business, which is being built up in the state. The fourteen farms to be served rank in size from 1,000 acres to 5,000 acres. Cotton heretofore has been the sole crop, but the planters are learning to diversify. Already one of them has five large dairies in operation.

KENTUCKY UTILITIES COMPANY'S GROWING NETWORK.—The Kentucky Utilities Company announces the starting of work on a 4,350-ft. span for 66,000-volt transmission across the Ohio River at Mound City, Ill. Two skeleton steel towers, each about 350 ft. high, one on the Kentucky and the other on the Illinois shore of the Ohio River, will be the outstanding feature of this line of H-frame type. The span is one of the longest in the country. When finished it will interconnect the transmission system of the Central Illinois Public Service Company and that of the Kentucky Utilities system in western Kentucky. The Illinois company is building the line on the north side of the river, and the Kentucky company is building it from Barlow to the river, a distance of 6 miles. The company announces also that the 33,000-volt, 16-mile transmission line recently built from Springfield to Bardstown has been put in operation, so that Bardstown now receives power from the Dix Dam hydro-electric plant; that a 33,000-volt, 14-mile line between Lebanon and New Haven is ready, and that its Leitchfield-Caneyville line will be completed about Dec. 10.

APPLICATION TO BUILD HYDRO PLANT ON THE LLANO RIVER.—If the Texas Board of Water Engineers grants an application which has been filed with it by Ward Arnold of Chicago, representing the Syndicate Power Company of Dallas, which is affiliated with the Insull interests, a large dam and hydro-electric plant will be constructed on the Llano River, it is authoritatively stated. The pending application is for a permit to make surveys of that stream from its mouth to the town of Llano, 27 miles, preliminary to locating reservoir and dam sites. The Syndicate Power Company has already obtained permits for constructing six dams and power plants on the Colorado River, into which stream the Llano River empties, though opposition has manifested itself. (See ELECTRICAL WORLD for Aug. 27, page 428.)

RECEIVERSHIP PROVES EXPENSIVE FORM OF MANAGING SMALL COMPANY.—The high cost of operating a small electric utility under receivership is reflected in testimony heard in a Portland (Ore.) court during the trial of a case involving the insolvency of the Vernonia Light & Power Company. Although the plant is now operating with an income of $2,200 per month and at a normal expense not to exceed $700 per month, it required $10,000 to cover the operating costs found necessary by a receiver for a period of six months. The Vernonia utility, situated in a promising field, was established by money subscribed to a bond issue in the total sum of $125,000 and was, it is said, forced into a receivership through inefficient management. The shareholders are now seeking official dismissal of the receiver on the ground that the utility is capable of operation on a paying basis.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

National Association of Utility Secretaries—Oklahoma City, Dec. 5-7. E. F. McKay, 307 Local Bldg., Oklahoma City.

American Society of Mechanical Engineers—New York, Dec. 5-8. C. W. Rice, 29 West 39th St., New York.

National Electrical Credit Association—New York Division, Dec. 13. W. J. Kreger, 261 Broadway, New York.

New England Central Station Association of Power Engineers—Chamber of Commerce, Boston, Dec. 15. T. D. Bond, Room 941, 200 Devonshire St., Boston.

American Physical Society—Nashville, Dec. 28-30. H. W. Webb, Columbia University, New York.

American Engineering Council—Washington, D. C., Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington.

National Electrical Manufacturers' Association—Supply Division, Hotel Commodore, New York, Jan. 23-30. S. N. Clarkson, 420 Lexington Ave., New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

American Institute of Electrical Engineers—Winter convention, New York, Feb. 13-16. F. L. Hutchinson, 33 West 39th St., New York.

RATE REDUCTION AND SERVICE EXTENSION IN NEW HAMPSHIRE.—Domestic users of electricity in Manchester, Nashua, Keene and more than a score of other New Hampshire cities or towns were gratified on Thanksgiving Day by an announcement from the Public Service Company of New Hampshire that on and after Jan. 1 there would be a reduction in rates amounting to fully $80,000 a year and applying to more than 35,000 homes. The new scale is based on the "active-room" plan. Using a five-room house for illustration, there will be a saving of from 31 to 32 cents a month, or from 9 to 10 or more per cent. The same company has just brought into service in the town of Weare, in southern New Hampshire, a 6,600-volt line, 23.3 miles in length, which will serve four villages and adjacent rural territory.

BICENTENARY OF NEWTON'S DEATH IS OBSERVED.—Addresses by Dr. M. I. Pupin of Columbia University, former president of the A.I.E.E.; Dr. David Eugene Smith of Columbia, Dr. D. C. Miller of the Case School of Applied Science, Cleveland; Dr. G. D. Birkoff of Harvard, Dr. Florian Cajori of the University of California, Dr. Paul R. Heyl of the Bureau of Standards, George E. Roberts of the National City Bank, Dr. E. W. Brown of Yale and Dr. W. W. Campbell of the University of California were included in exercises which, under the auspices of leading scientific and mathematical societies, were carried out on Nov. 25 and 26 at the American Museum of Natural History, New York City, in commemoration of the bicentenary of the death of Sir Isaac Newton, whose life spanned the years from 1642 to 1727.

PHILADELPHIA ENGINEERS' CLUB TO CELEBRATE ITS FIFTIETH ANNIVERSARY.—Seven men of national prominence will address the Engineers' Club of Philadelphia when it celebrates its fiftieth anniversary on Friday and Saturday, Dec. 16 and 17, with a general program entitled "Engineering Progress and World Civilization." John R. Freeman and Ambrose Swazey will discuss "The Past in Engineering" on Friday evening; William C. L. Eglin, Howard Elliott and Charles M. Schwab "The Present in Engineering" on Saturday afternoon, and Samuel Rea, Dexter S. Kimball and John Hays Hammond "The Future in Engineering" on Saturday evening. On Saturday morning there will be a special convocation at the University of Pennsylvania for the conferring of honorary degrees. All the other

assemblies of the engineers will be at the Bellevue-Stratford. Non-members of the club desiring to participate should communicate with Charles E. Billin, its secretary, before Dec. 12.

CENTRAL MAINE POWER WILL BUILD 5,500-HP. HYDRO PLANT.—The Central Maine Power Company will soon have another hydro-electric generating station on the Lewiston side of the Androscoggin River directly across from the company's present station at Deer Rips. The new power development, which it is planned to complete by next June, will be capable of developing 5,500 hp. and will consist of a single generating unit operated by remote control from the station across the river. The site is approximately one mile south of the company's new Gulf Island 27,000-hp. hydro development, the output of which, under prospective demands, will be consumed by 1928. The decision to build was the result of a study which showed that reconstruction work necessary on the present dam and generating station at Deer Rips would cost more than to erect a new station on the opposite side of the stream. The site will enable the company to utilize water flowage on either side, affording a convenient alternative in case of ice troubles.

BOSTON ENGINEERS TO STUDY WELDING.—An exhaustive symposium on modern welding will provide an all-day and evening program on Dec. 14 under the auspices of the Affiliated Technical Societies of Boston. Frank B. Walker will preside at the morning session in Chipman Hall, and papers will be presented by F. M. Farmer, president American Welding Society; Gilbert D. Fish, Westinghouse Electric & Manufacturing Company, and Andrew Vogel, General Electric Company. In the afternoon, at the City Club, under the chairmanship of George A. Carpenter, there will be papers by Le Roy Edwards, Air Reduction Sales Company; D. H. Deyoe, General Electric Company; Robert L. Browne, Metal & Thermit Corporation; A. Krebs, General Welding & Equipment Company, and C. A. McCune, American Chain Company. At the evening session, under the chairmanship of Lewis E. Moore, the program comprises papers by Fred T. Llewellyn, A.S.C.E.; W. T. Ober, Thomson Electric Welding Company; C. W. Babcock, Westinghouse company, and P. Alexander, General Electric Company.

OPENING OF BENNINGS PLANT ADDITION AT WASHINGTON DRAWS 300 PROMINENT GUESTS.—Three hundred visitors, including the Commissioners of the District of Columbia, the members of the Public Utilities Commission of the District and their staff, other public officials, engineers, technicians, business men and prominent citizens, gathered at the Bennings plant of the Potomac Electric Power Company, Washington, on Nov. 22 to inspect the 30,000-kw. addition to the generating facilities which has just gone on the lines. Charles J. Bell, chairman of the board, and President William F. Ham received the visitors and told them of the company's coming ten-year program involving capital expenditures of $35,000,000. The new extension contains, besides the turbo-generator and electrical auxiliaries, four additional 1,370-hp. boilers operating at increased pressures. The plant was designed and constructed by Stone & Webster under the supervision of Lindley E. Sinclair, general superintendent of the Potomac Electric Power Company, and cost approximately $3,000,000. It now has a total generating capacity of 148,000 kw.

Commission Rulings

AUTHORITY FROM COMMISSION NOT NEEDED FOR EXTENSION OF EXISTING DAM.—A complaint against the failure of the Pacific Gas & Electric Company to obtain authority from the California Railroad Commission for certain construction work in connection with the completion of an extension to a dam has been dismissed by the commission on the ground that its general order directing that "no public utility shall begin the construction of any dam" without filing plans and specifications did not apply in a case where the construction was in connection with an extension of a dam as distinguished from original construction.

MUNICIPAL PLANT ENTITLED TO EARN RETURN EQUAL TO WHAT PRIVATE PLANT WOULD HAVE TO HAVE.—In settling a complaint of discriminatory rates brought by customers against the municipal water plant of Great Falls, Mont., the Montana Public Service Commission made the following observations: "The city takes the position in this case that it is entitled to the same return that a private utility would be entitled to, and that the saving which it is able to accomplish in the cost of securing capital properly belongs to it. Generally speaking, Montana cities are able to borrow money in sufficient amounts to finance their public utilities at lower rates than private utilities can obtain on borrowed capital, and at rates considerably lower than the total cost of all the capital required by private utilities. This is because the taxing power of the city secures the payment of principal and interest on general city bonds. If the municipal utilities had to be financed on the basis of the property and the credit of the utility department alone, the cost of their capital would undoubtedly be materially increased. We think that the taxpayers are reasonably entitled to be compensated for the use of the general credit of the city by being permitted to earn a return, if they so desire, upon the utility property equal to the return which a private company would have to have and which would constitute a fair return for such company. It is proper to make adequate provision for the future, though rates should not be so high as to recruit capital which ought to come from the taxpayers instead of the ratepayers. Broadly speaking, the ratepayers' duty is to pay for the use of the plant; the taxpayers' duty is to contribute the necessary capital."

Recent Court Decisions

COMPENSATION REFUSED TO LICENSEE FOR INJURY RECEIVED ON RIGHT-OF-WAY.—In Borgnis vs. California-Oregon Power Company, the California District Court of Appeal held that one who was not a patron of a hotel but was fishing on its land and was injured while crossing the power company's right-of-way was a licensee rather than an invitee and could not recover for injuries sustained when the steel fishing rod which he was carrying came in contact with a sagging wire of the California-Oregon Power Company's line. (258 Pac. 394.)*

MUNICIPAL LIABILITY IN OPERATING LIGHTING SYSTEM AS PROPRIETARY FUNCTION.—The United States Circuit Court of Appeals in Texas found, in City of Galveston vs. Rowan, that the city in operating a street-lighting system for the purpose of lighting the roadway of the sea wall, but not supplying energy for profit to private parties, was engaged in a proprietary rather than a governmental business and was liable in the same degree as another would be for damages arising from the operation of said plant. (20 Fed. [2d] 501.)

DUTY OF SAFEGUARDING HIGH-VOLTAGE WIRES AND TRANSFORMERS.—Two cases were tried in North Dakota with the designation of Mayer vs. Central Light & Power Company. One was to recover damages for personal injuries to a ten-year-old boy who came into contact with electrical apparatus as he was walking on a highway near an inclosure, and the other was to recover consequential damages for his care while injured. It was asserted that electricity escaped from the transformers in the inclosure and that the fence, the ground wire and other surroundings became charged. The boy, walking on a road about five feet from the transformers, picked up a piece of iron and rattled it along the fence, which was built of pickets. The boy received severe burns on one hand and both feet from escaping electricity. The Supreme Court of North Dakota has sustained judgment for the plaintiff. (215 N. W. 287.)

CONDEMNATION RIGHTS NOT AFFECTED BY TERMS OF FEDERAL POWER LICENSE.—In State ex rel. Perry vs. Superior Court for Chelan County, the Washington Supreme Court held that the acceptance by an electric company of a Federal Power Commission license providing that the licensee might reconstruct or replace any dock damaged by raising the water level, unless the owner of such dock should have been otherwise compensated for damage, did not prevent the condemnation by the company of a private commercial dock which would be covered by water a considerable portion of the year. The court said: "By the express provisions of the license, the petitioner may either reconstruct or replace, or may otherwise compensate the owner. It has elected to proceed under the provisions of our constitution and laws and take the property in its entirety and pay just compensation therefor. We hold that by the acceptance of this license petitioner's rights under our condemnation statute have not been modified." (259 Pac. 382.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

H. I. Harriman Vice-Chairman of New England Power

Henry I. Harriman, who resigned from the presidency of the New England Power Association last week to become vice-chairman of the board of directors, is one of the best known utility men in the East. He was born in New York in 1873 and was educated at Wesleyan University and the law school of New York University. He entered the electrical field about twenty years ago, and in association with Malcolm G. Chace he built the 20,000-hp. Vernon station of the Connecticut River Transmission Company and the associated 66-kv. lines to deliver energy from this development in central Massachusetts. From these beginnings grew the present New England Power Company system. Against obstacles little realized today Mr. Harriman and his associates created a property which pioneered in so-called "superpower" methods of production and regional distribution in a then highly conservative territory. An exponent of the economic benefits of wholesaling electrical energy, of the highest grade engineering design and construction, of distributed security ownership and of far-sighted stream regulation, this management has made a striking name for itself in New England electrical history. Mr. Harriman is a member of the banking house of Baker, Young & Company, Boston; was president of the Boston Chamber of Commerce for two years, and is now chairman of the Metropolitan Planning Division, Boston.

Anniversary Banquet Given to Boston Edison Officials

W. H. Atkins, vice-president and general superintendent; W. H. Francis, purchasing agent, and Fred G. Havlin, assistant treasurer and secretary to the president of the Edison Electric Illuminating Company of Boston, were guests at an anniversary dinner at the Engineers' Club of Boston Nov. 22, each being presented with an electric chime clock in commemoration of long service with the company. President Charles L. Edgar was master of ceremonies, and during the banquet many messages of congratulation were received from friends in the electrical industry throughout the country. Mr. Atkins' fortieth anniversary with the company occurred Dec. 1; Mr. Havlin's thirty-fifth and Mr. Francis' thirty-fifth occurred on Nov. 14 and Nov. 20 respectively.

STANLEY BROWN, formerly with McClellan & Junkersfeld, Inc., New York, and Dwight P. Robinson & Company, Inc., New York, has joined the electrical division of Stone & Webster, Inc., Boston. While with the former organization Mr. Brown was assigned to work on the plant of the North American Cement Corporation, Catskill, N. Y., and when with the latter he was engaged in the construction of the Seal Beach station of the Los Angeles Gas & Electric Corporation.

THOMAS FINNERTY, for more than ten years manager of the Otter Tail Power Company's plant at Langdon, N. D., has resigned. Mr. Finnerty will remove to the West Coast, where he will make his future home.

F. D. Comerford President of New England Association

Frank D. Comerford, whose election as president of the New England Power Association was announced in last week's issue of the ELECTRICAL WORLD, is a member of the law firm of Ropes, Gray, Boyden & Perkins of Boston and one of the youngest executives of a large utility organization in the country. He was born at Worcester, Mass., in 1893 and was educated at Holy Cross College in that city and at the Harvard Law School, from which he was graduated in 1917. He began practice in the office of Ropes, Gray, Boyden & Perkins and several years later was admitted to partnership. Early in his legal career he became a specialist in public utility law, working in close association with A. R. Graustein, another member of the firm, who later became president of the International Paper Company and is now chairman of the board of directors of the New England Power Association. When that association was formed early in 1926 Mr. Comerford was made its general counsel.

F. D. COMERFORD

W. J. THARP, who has been connected with the Arkansas Power & Light Company, has resigned to become an official of Kaufman & Baer, a department store in Pittsburgh. Mr. Tharp has been affiliated with the electrical industry in Little Rock for more than 28 years and during this period has served on special committees of the National Electric Light Association and the American Electric Railway Association.

RENZO NORSA, managing director of the Compagnia Generale di Elettricita of Italy, sailed for Europe last week aboard the *Conti Biancamano*. Mr. Norsa had spent six weeks in this country, studying general electrical conditions.

Obituary

CHARLES O. BAKER, for eighteen years sales manager of the Wheeler Reflector Company, Boston, died suddenly Nov. 8. Mr. Baker had long been active in the electrical manufacturing industry.

J. B. PHINIZY, a director of the Georgia Power Company and one of the state's pioneer builders, died Oct. 25 at his home in Athens, following a short illness. Mr. Phinizy was president of the Southern Mutual Life Insurance Company, the Southern Manufacturing Company and other corporations, as well as a director in several banks. He was 66 years of age.

ARTHUR F. BLASDELL, who resigned as works manager of the General Electric Company's plant at Pittsfield, Mass., last December, died suddenly Nov. 27 in Santa Ana, Cal., in his fifty-sixth year. Mr. Blasdell removed to California early this year because of ill health. He had been works manager of the Pittsfield works for sixteen years. Mr. Blasdell was at one time a member of the American Institute of Electrical Engineers, the Engineering Society of Western Massachusetts and the American Society of Mechanical Engineers, but relinquished his membership after removing to the West.

CHARLES B. MANVILLE, founder of the Johns-Manville Corporation and pioneer in the manufacture of insulating materials, died Nov. 26 at his home in Pleasantville, N. Y., from a stroke of apoplexy. Though early in his career he was engaged in garment manufacturing in Milwaukee, Mr. Manville became interested in the production of an effective insulating material. As a result he devoted special attention to experimental work in this field, and it was not long before the Manville Covering Company, the parent of the several later companies bearing the family name, was a successful enterprise. After the company had established plants in many cities it moved its headquarters to New York in 1900, and after purchasing the H. W. Johns Company it became known as the H. W. Johns-Manville Company, with Mr. Manville as president. In 1920 the company name was changed to Johns-Manville, Inc., and early this year the name was again altered to the Johns-Manville Corporation. Mr. Manville retired from active participation in business in 1902. He was 96 years of age.

Financial and Statistical News

Utility Markets Firm
New High Prices
Dividends Make Record

PUBLIC utility stocks record another week of creditable behavior in the markets. New high levels have been reached in several stocks, and averages have moved upward on consistent buying. Several of the utility issues seem to have assumed the guise of market leaders rather than followers as most of them have been for some weeks. Among the features is Brooklyn Edison, which has reached a high of 197 for the present movement, a rise of more than 20 points during the month. Substantial advances were made also by American Gas & Electric, Commonwealth Edison, Detroit Edison and Public Service of New Jersey.

Preferred stocks have continued firm without any outstanding advances. As suggested by one of the financial houses in a statement issued this week, dividends paid by light and power companies on preferred stocks will constitute a record this year. While there is nothing radical about such a statement, each year being a record year in this respect just as it is in respect to virtually every other aggregate figure relating to the power and light industry, it draws attention to the huge amounts accruing to shareholders year by year. Last year some $350,000,000 was added to the industry's capitalization in the form of preferred stock, through customer sales and otherwise. This means that annual dividend payments were increased by nearly $20,000,000, allowing for the retirement of higher-priced issues. While customer sales have fallen off somewhat this year and the money market has been particularly receptive to mortgage bond financing, the sale of preferred stock will not be much below that of last year according to ten-month figures.

German Electrical Output Over 20,000,000,000 Kw.-Hr.

Statistics of electrical output in Germany now compiled for the first time, including not only public but all private industrial and agricultural power stations, show that in 1925 20,300,000,000 kw.-hr., or 325 kw.-hr. per capita, was generated. Germany, while ranking second in electrical output, is behind Switzerland, Norway, Sweden and others as regards the per capita production. During 1925 15,226,297,621 kw.-hr. was produced from solid fuel and 2,851,774,681 kw.-hr. from water power. The statistical survey for 1925 covered 9,563 establishments, of which 8,726 supplied the required statistical material, the remainder being small undertakings. Of the total of 8,726 establishments, 1,370 were public stations with an output of 9,900,000,000 kw.-hr., 6,122 were independent industrial stations with an output of 10,400,000,000 kw.-hr., while 1,234 were distributing plants without any output.

Of the 1,370 public power stations, 630, with a total output of 4,300,000,000 kw.-hr., were publicly owned, while in 147 partly public and partly private enterprises the majority of the stock on an average was publicly owned. Of the 1,234 distributing works, 854 plants, or about 49 per cent, were publicly owned. The capital invested in public utilities at the end of 1926 is estimated as 2,000,000,000 reichsmarks (one reichsmark equals $0.238) in power stations and from 4,000,000,000 to 6,000,000,000 reichsmarks in the distribution system.

Public Service Corporation Authorizes Large Issue

Directors of the Public Service Corporation of New Jersey have voted to issue 6 per cent cumulative preferred stock to the amount of $33,600,000. Holders of common and preferred stock of record Dec. 2 will have the right to subscribe for the new issue at $102 per share, at the rate of one share of new stock for each fifteen shares of common and preferred stock owned. Warrants will be issued Jan. 10, 1928, and rights will expire Feb. 1, 1928. Shares must be paid in installments as follows: $25 on Feb. 1, 1928; $25 on March 31, 1928; $25 on June 30, 1928, and $27 on Sept. 30, 1928. Interest will be paid by the corporation on all installments at the rate of 5½ per cent per annum.

Utility Security Holders Form Protective Association

National Association of Owners of Railroad Securities Extended to Include Public Utility Security Owners

By Milton W. Harrison

President National Association of Owners of Railroad Securities

CHANGING the name of the association to that of National Association of Owners of Railroad and Public Utility Securities, with objectives that embrace public utility securities as well, effectively carries out the reason for the establishment of the national association in 1917. Since that date holders of railroad securities have become extensive investors in public utilities.

At present Congress and the commissions undertake to represent the investors without the help of the investors themselves. It becomes, therefore, an obligation of nation-wide importance that investors effectively put themselves in a position not only to be of constructive assistance to Congress and to regulatory commissions, but to protect and stabilize the securities they own. Unwise legislation and regulation can do much damage to the soundness of security values because the industries behind such securities are under government control.

This association is in the happy position of desiring only the application of sound economic principles. Our interests are wholly parallel with those of legislatures, courts and regulatory bodies. No organization is so favorably positioned as ours to perform constructive service. The identity of our interest with that of the public interest will be apparent to all. But let this be clearly understood, our views will not carry weight unless we enunciate them.

With regard to railroads, of great importance to our interest is the question of primary valuations. Under the authority of the interstate commerce act the commission has prosecuted this work for more than a decade along lines which it has itself laid down. The commission's methods have been earnestly protested by parties at issue and with the greatest divergence of opinion. Several attempts have been made by protestants to secure review by the Supreme Court, but such petitions have been dismissed pending the time the commission seeks to make practical application of its valuation findings. Such court review will probably be had in the early months of 1928. It is of great importance to us that valuation principles and procedure are still in a formative state and are susceptible of being molded by Congress and by courts along lines radically different from those adopted by the commission. Valuation organizations representing irreconcilable interests are being maintained in Washington. These include besides the railroads themselves and state public service commissions, the organizations of labor, and such, for example, as the National Conference on Valuation fathered by the late Senator La Follette and still active under congressional leadership. It must be manifest that these interests emphasize the necessity and urgent importance of our

concerted action. Our duty to take a position consistent with sound public policy is clear-cut.

Likewise, that phase of valuation looking to recapture is in its infancy. In the event the commission's ruling in the O'Fallon case is reversed by the court, a flood of bills dealing with the subject is to be expected in the new Congress. So far as I am advised, no one has undertaken to study the O'Fallon decision from the aspect of its effect upon national transportation. This latter feature obviously should be of great importance to the commission, to the Supreme Court, to Congress, and of supreme importance to investors.

There are almost daily before the Interstate Commerce Commission finance dockets involving the issuance or retirement of security issues with which we are most directly concerned. There are pronounced indications that the commission is slowly evolving a policy on financial structures which will in the future be controlling upon it. We should certainly know how our interests are affected in these cases and be in a position effectively to intervene whenever it is necessary. Railway taxation also is receiving constantly increasing attention on the part of executives, legislators and others. The relation between valuation for rate making and for taxation should be more earnestly studied, and we should, I believe, participate constructively to inform the public on this and similar matters.

CAPITALIZATION OF OTTAWA LIGHT, HEAT & POWER COMPANY INCREASED.—Shareholders of the Ottawa Light, Heat & Power Company on Nov. 10 approved an increase in the capital stock from $5,000,000 to $10,000,000.

December Financing Makes Promising Start

New offerings of electric light and power securities on Dec. 1 amounted to $15,500,000, three separate issues contributing to this total. The Louisiana Power & Light Company issued first mortgage gold bonds to the amount of $8,000,000 at 97¾ and accrued interest, and the Connecticut Light & Power Company issued 5½ per cent cumulative preferred stock to the amount of $6,500,000. The price of this stock is par flat, before Dec. 6, 1927, thereafter par and accrued dividends. The United Public Service Company issued 10,000 shares of preferred stock, priced at $100 and accrued dividends yielding 7 per cent.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Oct. 31 1927	1926
American Power & Light	$62,634,836	$59,351,360
Bangor Hydro-Electric	1,870,042	1,685,921
Elec. Pwr. & Lt. (subsid.)*	52,110,492	48,749,154
National Pwr. & Lt. & subs.*	36,254,255	32,699,152
Nevada-California Electric	5,137,960	4,980,199
New York Power & Light	17,802,062	16,619,100
Northern Ohio Power	12,438,040	11,970,259
Portland Electric Power	12,127,976	11,608,906
Public Service of New Hamp.	3,660,497	3,558,482
Southern California Edison	30,399,571	27,185,093

* Twelve months ended Sept. 30.

MANITOBA STOCKHOLDERS VOTE STOCK INCREASE.—Shareholders of the Manitoba Power Company on Nov. 10 ratified the proposal to increase the authorized capital stock from 100,000 to 200,000 shares of no par value. The company will now offer 50,000 shares of stock to shareholders at $60 a share in the proportion of one share for each two now held.

Utility Financing 20 Per Cent Higher Than in Entire Year 1926

DURING the month of November new issues of electric light and power securities amounted to $182,231,000, as compared with $210,555,000 in October and $120,865,000 in November, 1926. For the eleven-month period which closed this week a total of $1,440,302,200 was recorded, a sum which is $290,000,000 in excess of the figure recorded for the entire year 1926.

Two companies—the Cities Service Power & Light and the Public Service Electric & Gas—contributed $90,000,000 to November's total, each accounting for $45,000,000.

Out of sixteen individual offerings, five were in the form of preferred stock. Attention is called to the prominent part taken by refunding operations. The new financing was exclusively of a long-term nature, and the average yield advanced in November to the 5.13 per cent mark.

Security Issues of Electric Service Companies in November

Name of Company	Amount of Issue (Par Value)	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Cities Service Power & Light Co.	$45,000,000	25	Gold debentures	To provide additional working capital and to retire funded debt of subsidiary companies	5½	98	5.65
Philadelphia Suburban Counties Gas & Electric Co.	10,000,000	30	First and refunding mortgage gold bonds	To retire underlying bonds and to reimburse for expenditures made for additions and improvements to its properties	4½	98	4.62
Penn Central Light & Power Co.	24,000,000	50	First mortgage gold bonds	To retire bonds	4½	96	4.70
California Oregon Power Co.	4,000,000	15	Gold debentures	To reimburse for expenditures on additions and for other corporate purposes	5½	98½	5.65
Electric Bond & Share Co.	10,000,000	..	Cumulative preferred stock	For general corporate purposes in expanding the company's business	6	109	5.50
American Commonwealths Power Corp.	1,440,000	..	First preferred stock, series A	To acquire stock	7	96	7.25
Central Public Service Co.	1,500,000	..	Cumulative preferred stock	To reduce indebtedness, acquire properties and for other corporate purposes	7	100	7
Islands Edison Co.	400,000	..	Cumulative preferred stock	To pay off indebtedness, for additions and extensions and for other corporate purposes	7½	102½	7.31
Midland Utilities Co.	2,375,000	..	Cumulative prior lien stock	To retire notes and for other corporate purposes	6	95	6.31
Wisconsin Hydro-Electric Co.	2,000,000	20	First mortgage gold bonds	Acquisition of properties and for other corporate purposes	5	95½	5.37
Florida Public Service Co.	1,814,000	28	First mortgage gold bonds, series B	To pay for extensions made to properties	6	101	5.90
Ohio Power Co.	9,702,000	29	First and refunding mortgage gold bonds, series D	To retire securities now outstanding	4½	94½	4.84
Illinois Power & Light Corp.	5,000,000	29	First and refunding mortgage gold bonds, series C	Additions to property	5	98	5.13
Public Service Electric & Gas Co.	45,000,000	40	First and refunding mortgage gold bonds	To retire bonds and to reimburse for expenditures made for additions to properties	4½	98	4.60
Mississippi Power & Light Co.	9,000,000	30	First mortgage gold bonds	Refunding and to reimburse for expenditures on properties	5	97½	5.18
Railway & Light Securities Co.	1,000,000	25	Collateral trust sinking fund bonds		5	99	5.07
Arkansas Power & Light Co.	3,000,000	29	First and refunding mortgage gold bonds		5	99	5.06
Columbus Electric & Power Co.	2,000,000	27	First and refunding mortgage gold bonds, series B		5	101.87	4.87
North America Light & Power Co.	5,000,000	29	Sinking fund gold debentures	Investments in and advances to subsidiary and affiliated companies	5½	96½	5.75

Total ..... $182,231,000 (Par value)
Total amount actually realized $178,838,335

Rights $18,113,592
Total financing for November $196,951,927

September Power Output in Canada up 10 Per Cent

A decline is reported in the output of central electric stations in Canada during September. Complete returns from the various operators show an output of 993,114,000 kw.-hr. This compares with 1,034,900,000 in the preceding month and with 929,387,000 in September a year ago. Electric power generated from water was not so great in amount during the month, output having totaled 976,756,000 kw.-hr., or 32,679,000 less than in the previous month. On the other hand, power output credited to fuel remained virtually stationary, being still above average.

Output of electrical energy dropped in each of the five main economic areas, with the exception of the prairie provinces. In August the maritime stations accounted for a production of 12,115,000 kw.-hr., while for September the total had declined to 9,236,000. This is the greatest percentage decrease. Both Quebec and Ontario show small decreases. Quebec produced 339,237,000 kw.-hr. as compared with the high of 357,634,000 for the current year, attained in August. There was a fairly substantial increase in comparison with September last year, output in that period having totaled 317,884,000. Ontario's output dropped from 494,758,000 kw.-hr. in August to 437,054,000 in September. This percentage loss is slightly less than in Quebec. Output of the prairie provinces in September, standing at 75,009,000 kw.-hr., was the highest recorded in the past five months and is over 40 per cent greater than in the corresponding month of 1926. While many of the prairie industrial sections are still dependent upon steam power, it is noticeable that the water-power resources of that territory are being more widely exploited.

While the total monthly exports of electrical energy in September were somewhat less than in August, the government's records show average daily exports of 5,141,000 kw.-hr. as compared with 5,071,000.

Cumulative figures on output for the first nine months of the current year show an increase of nearly 10 per cent over the figure for the corresponding period of last year. From January to September, 1927, production of central electric stations in Canada totaled 8,866,000,000 kw.-hr. as against 8,110,684,000 in the same nine months in 1926, an increase of 745,316,000. Each of the five main areas reports an increase over last year, averaging about the same ratio. At the same time exports increased from 1,106,231,000 kw.-hr. in 1926 to 1,229,836,000 this year.

Canadian Utility Makes Five-Million-Dollar Offering

Thirty-year 5 per cent convertible debentures, series A, of the Power Corporation of Canada, Limited, were recently offered to the amount of $5,000,000 at 98½ and accrued interest to yield about 5.10 per cent. Proceeds of the sale of these debentures will be used for the acquisition of the control of, or a substantial interest in, hydro-electric and public utility companies. Debentures may be converted at the option of the holder at any time before Dec. 1, 1932, into the no-par-value common stock of the company on the basis of one share of stock for each $100 par value of series "A" debentures.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 29	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	141½	83	141½
Ala. Pwr., $7 cum. pf.—no par	112	107	112½
Allis-Chalmers Mfg., 6% com.	117½	88	118½
Aluminum Co. of Amer., com.	143	67½	145½
Aluminum Co. of Amer., 6% pf.	104½	101½	104½
Amer. & Foreign Pwr., 7% pf.—no par	106½	86½	108
Amer. & Foreign Pwr., com.—no par	28½	18½	30½
Amer. Bosch Magneto, com.—no par	24½	13	26½
Amer. Brown Boveri Elec†	13½	5½	39½
Amer. Brown Boveri Elec., pf. $7	58	40	98
Amer. Gas & Elec., 6% pf.—no par	105	95½	105
Amer. Gas & Elec., com.†—no par	120½	68½	125
Amer. Lt. & Trac., 6% pf.	112	112	120
Amer. Lt. & Trac., new com.	£176	164½	186
Amer. Pwr. & Lt., 6% pf.	108½	97½	108½
Amer. Pwr. & Lt., com.†—no par	65½	54	73½
Amer. Pub. Serv., 7% pf.	*a* 98½	94	104
Amer. Pub. Serv., com.†	85	65	75
Amer. Pub. Utilities, 7% pfc. pf	*a* 89	73	90
Amer. Pub. Utilities, 7% pr. pf.	*a* 94½	92	96
Amer. Pub. Utilities, com.	£ 57	65	70
Amer. States Sec., A	4½	2½	4½
Amer. States Sec., B	4½	2½	4½
Amer. Superpwr., 6% pfc pf.—25	£ 28½	26½	29½
Amer. Superpwr., 6% 1st pf.	*l* 99½	....	....
Amer. Superpwr., Class A†—no par	41½	27½	41½
Amer. Superpwr., Class B†—no par	42½	28½	43
Amer. Wtr. Wks. & Elec., 6% pf.	101½	99½	101½
Amer. W. W. & E., com. new—no par	61½	46	72½
Anaconda Copper cap. $3	52½	41½	53½
Appalachian Electric Pwr., 7% pf.	106½	100	105
Arizona Pwr., com.	*m* 20	....	....
Arkansas Pwr., & Lt. 7% pf.	106½	97½	108
Assoc. Gas & Elec., $3.50—50	52	....	....
Assoc. Gas & Elec., pf.—$6—no par	94	85	96
Assoc. G. & E., Class A, 10—no par	49½	35	49½
BABCOCK & WILCOX, 7% com.	126	113	132
Binghamton L., H. & P., $6 pf.	101	93	102
Birmingham Elec., pf.—$7—no par	109½	105	110
Blackstone Valley G. & E., 6% pf.	107	103	105
Blackstone Valley Gas & Elec., 10% com.—50	£128	98	153
Blaw-Knox, com.†	£110	70	110
Brazilian Trac., Lt. & pwr., com.†	*f*221½	....	....
Broad River Pwr., 7% pf.	103	97	104½
Brooklyn Edison, 8% com.	197	148½	203½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*l* 26½	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	*l* 33½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	*l*109½	96	109½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	*l*109½	107	109½
Central & S.W. Util., $7 pf.—no par	*a* 98	92½	99
Central & S.W. Util., pr.in.$7 pf.—no par	*a*102½	98½	104½
Central Ark. Ry. & Lt., 7% pf.	106	100	104
Central Ill. Pub. Serv., $6 pf.	*a*95½	88½	96
Central Ind. Pwr., 7% pf.	*a* 95	85½	95
Central Maine Power, 6% pf.	95	....	....
Central Maine Power, 7%	106	102	106
Central Pwr. & Lt., 7% pf.	102½	100½	103
Central States Elec., 7% pf.	99	93	97
Central States Elec., com.†	*m* 29½	17½	30½
Century Elec., 6% com.	*m*136½	114	162
Chicago Fuse Mfg., com.—$2.50 no par	*m* 31	30	35½
Cincinnati Gas & Elec., 5% com.	*g*100½	96½	101½
Cities Service, $6 pf—no par	*l* 94½	87	94½
Cities Service, pf. B—no par	*l* 8½	8	8½
Cities Service, pf. BB—no par	*l* 88	80½	86
Cities Service, com.—20	*l* 51½	40½	58½
Cities Service, Bks. Shrs.—10	*l* 25½	22½	27
Cities Service Pwr. & Lt., 7% pf.	£105½	100½	105½
Cities Service Pwr. & Lt., 6% pf.	95½	90	95
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	112	108	112
Cleveland Elec. Illg., 10% com.	330	285	340
Columbia Gas & Elec., 6% pf.	108½	99½	108½
Columbia G. & E. com. $5—no par	92	82½	98½
Columbus Elec. & Pwr., $2 com.—no par	67	....	....
Columbus Elec. & Pwr., 7% pf.	111	....	....
Columbus Ry., Pwr. & Lt., 6%, 1st pf.	104	98½	106
Columbus Ry., Pwr. & Lt., 6½% pf. B	103	96	104
Columbus Ry., P. & L., com.—no par	100	75	105
Commonwealth Edison, 8% com.	*a*171	138	171
Commonwealth Pwr., 6% pf.	102½	91½	103½
Commonw'th Pwr., $2, com.—no par	67½	48½	78½
Conn. Lt. & Pwr., 8% pf.	121	119	123
Conn. Lt. & Pwr., 7% pf.	117	112	118
Cons. Gas of N. Y., pf.	101	93	101½
Cons. Gas of N. Y., com $5—no par	120½	94	121½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	£105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	*a*114	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	*a*114	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	*a*128½	127	130½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	*e* 68½	51	71
Consolidated Pwr. & Lt., 7% pf.	105	100	106
Consumers Pwr., 6% pf.	104½	100	102
Consumers Pwr., 6.6% pf.	106½	103	105½
Continental Gas & Elec., 8% pfc. pf.	108	103	106½
Continental Gas & Elec., 7% pr. pf.	103½	100	103
Conti. G. & E. com. $4.40—no par	£230	210	225
Crocker Wheeler, com.†	25	23	38
Crocker Wheeler, 7% pf.	80	78	88
DALLAS PWR. & LT., 7% pf.	110	107	110½
Dayton Pwr. & Lt., 6% pf.	108	101	109
Detroit Edison, 8% com.	165½	133½	167
Dubilier Condenser, com.—no par	£ 2½	2	5½
Duke Pwr., cap.	125	115	130
Duquesne Lt., 7% pf.	£116	114½	117½
EASTERN NEW YORK UTIL., $7 pf.	110	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	12½	11	14½
Eastern States Pwr., pf.	97	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	*d*245½	217	267
El Paso Elec., 7% pf.	108	105	107½
Elec. Bond & Share, 6% pf.	*l*109½	105½	110½
Elec. Bd. & Sh. Sec., com. $1—no pa.	*l* 75½	67½	80½
Electric Household Util.†	*a* 13	11	15½
Elec. Investors, 6% pf.—no par	98½	92	97
Elec. Investors, com.†—no par	44	32½	44½
Elec. Pwr. & Lt., ctfs. pf.	108½	96	109
Elec. Pwr. & Lt., ctfs., 40% pd.	£ 120	103½	120
Elec. Pwr. & Lt., ctfs., com.—no par	28½	16½	29½
Elec. Refrig. cap.†	9½	5½	37½
Elec. Ry. Securities, com.—no par	6½	....	....
Elec. St. Battery com. $5.25—no par	75½	63½	79½
Elmira Wtr., Lt. & R. R., 7% pf.	104½	99	101½
Empire Pwr., pfc.†	35½	26	39
Engr. Pub. Serv., $7 pf.—no par	94	....	....
Engr. Pub. Serv., com.—no par	34½	21½	39½
Eureka Vacuum Cleaner, com. $4—no par	76½	50	77
FAIRBANKS MORSE, 7% pf.	£107	107½	112
F.-M., com.—$3—no par	34½	30½	43½
Federal Lt. & Trac., com. $1.40	38½	37½	47
Federal Lt. & Trac., $6 pf.—no par	98½	91½	100
Florida Pwr. & Lt., 7% pf.	106½	102½	106½
Ft. Worth Pwr. & Lt., 7% pf.	*l*112	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	70	68	72
Galveston-Houston Elec., com.	33	26	32
Gen. Elec., $3 com.—no par	134½	81	146½
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A $1.50—no par	37½	34	47½
Gen. G. & E. (Del.) pf. A. $8—no par	£122	113½	123½
Gen. G. & E. (Del.) pf. A $7—no par	£109½	100	110½
Gen G. & E. (Del.) pf. B $7	£104½	96	105
Gen. Pub. Serv., $7 cum. pf., no par	113½	105½	113½
Gen. Pub. Serv., com., no par	£ 16	11½	18
Ga. Ry. & Pwr., 8% pf.	£125	119	125
Ga. Ry. & Pwr., 7% pf.	£113½	106	110
Gt. Western Pwr., 7% pf.	£104	....	..
IDAHO PWR., 7% pf.	108½	103	109
Ill. No. Utilities, 6% pf.	£ 96	88	97
Ill. Pwr. & Lt., 7% pf.	102	99	101½
Ingersoll Rand 6% pf.	£ 89½	87½	96½
Int. Combus. Engr., com. $2—no par	54½	40½	64
Int. Combustion Engr., 7% pf.	102½	101	102½
Int. Util., Class A—$3.50—no par	47½	28	47½
Int. Utilities, Class B—no par	8½	3	9½
Interstate Pwr., pf.—$7—no par	97½	93	98
Interstate Pub. Serv., 7% pf.	101½	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	106½	97½	105
Johns-Manville, com.†—no par	123½	55½	123½

Stock Exchange: *e*Chicago; *k*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Nov. 26. *l*Bid price Wednesday, Nov. 30. *m*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 29	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	116	112	116
Kansas Gas & Elec., 7% pf.	*108	103	107½
Kentucky Hydro-Elec., 7% pf.	a104	94½	104
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	115	110	115
Kentucky Utilities, 6% pf.	100	95	101
LACLEDE GAS LT., 12% com.	k230	173½	267½
Lehigh Pwr. Sec., com.—no par.	20½	15	22
Long Island Ltg., 7% pf.	110½	107	112
Long Island Ltg., com.†—no par.	170	140	174
Los Angeles Gas & Elec., 6% pf.	102½	98	104½
Louisville Gas & Elec., cl. A. $1.75	26½	23½	27½
MAN. ELEC. SUPPLY, cap. $5—no par	53½	43	132
Manila Elec., com.†—no par.	k 52	40	60
Maytag Mfg., com. .50—no par.	30½	23½	34½
Memphis P. & L., pf.—$7—no par	109½	107	109
Metropolitan Ed., pf.—$6—no par.	104½	93	100
Metropolitan Ed., pf.—$7—no par.	109	104	108
Metropolitan Ed., com. $5—no par.	75	60	72
Middle West Utilities, 7% pf.	a118	110½	118½
Middle West Util., 8% pr. lien	a126½	117½	127
Middle West Util., com. $6—no par	a120	108	121½
Midland Utilities, pr. in. 6% pf.	a 95½	91½	96
Midland Utilities, 7% pf. A	a100½	96½	103½
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	*108½	104	108
Miss. River Pwr., 6% pf.	106	94	104½
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	109	101½	112
Mohawk Hudson Pwr., 2d pf.—$7—no par	114	98	112
Mohawk Hudson Pwr., com.—no par	29½	20½	32½
Montana Pwr., 5% com.	103½	81½	109½
Montreal Pwr., 7½% com.	f 90½	....	....
Mountain States Pwr., 7% pf.	101	97	101
Mountain States pwr., com.†	18	....	....
NASSAU&SUFFOLKLTG.,7% pf.	107	98	110
National Carbon, 8% pf.	a137	130½	139½
National Elec. Pwr., A†	a 27	22	28½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 6% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	109½	101	110
National Pwr. & Lt., com.†—no par.	23	19½	26½
National Pub. Serv., 7% pf.	100½	93	100
National Pub. Serv., 7% pfc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par	22½	18½	24
National Pub. Serv., B com.—no par	27½	14	28½
Nebraska Pwr., 7% pf.	*109½	106	109½
Nevada-Calif. Elec., com.	k 26	22	27
New Brunswick Pwr., 4% pf.	60	....	....
New Eng. Pub. Serv., pr. in. pf. $7..	101	98½	102
New Eng. Pub. Serv., pf. $7.	98	95	99
New Orleans Pub. Serv.—7% pf.	107½	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	95	91	97
N. Y. Central Elec., 7% pf.	102½	101	104
New York Power & Light, 6% pf.	100	....	....
New York Power & Light, 7% pf.	114	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	k 28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	54	50	55
No. Amer., com.—10	63	45½	64½
No. Amer. Edison, $6 pf.—no par.	k102½	96½	105
No. Caro. Pub. Serv., pf.—$7—no par	101	93	102½
Northeastern Pwr., com.	21½	14½	25
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par.	17½	9½	18½
No. Ont. Lt. & Pwr., 6% pf.	k 94	84	95
No. Ont. Lt. & Pwr., 4% com.	72	73	78
No. States Pwr., (Del.) 7% pf.	109½	100½	110
No. States Pwr., (Del.) 8% com.	131½	109½	133
No. Texas Elec., 6% pf.	k 45	65	70
No. Texas Elec., com.	k 5	27	36
OHIO BRASS, com. B $4—no par.	106	74	106
Ohio Brass, 6% pf.	105	100	107
Ohio Pwr., 6% pf.	103½	96	103
Ohio Pub. Serv., $6 pf.	101	95	96½
Ohio Pub. Serv., 7% pf.	109½	103	109
Ohio River Edison, 7% pf.	108½	103	109½
Oklahoma Gas & Elec., 7% pf.	107½	...	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	46	31	46½
Pacific Pwr. & Lt., 7% pf.	*105	102	104½
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 79	75½	80
Penn-Ohio Edison, 6% pf. no par.	91½	80½	92
Penn-Ohio Edison, 7% pf.	108	97½	110½
Penn-Ohio Elec., 7% pf.	m102	99	103
Penn-Ohio Pwr. & Lt., 7% pf.	108	99	110
Penn Pwr.& Lt.—$7—no par.	*110½	107	110
Penn Wtr. & Pwr., 8% com., new	k 68½	45	74½
Phila Co., 5% pf.-50.	k 46	40	47
Phila. Co., 6% pf.—50.	k 52½	50	53½
Phila. Co., com.—50.	k128	85½	132
Phila. Elec., 8% com.—25.	c 54½	46½	58½
Portland Elec. Pwr., 7% pf.	101½	97½	102½
Portland Elec. Pwr., 6% pf.	70	75	84
Portland Elec. Pwr., 6% 2d pf.	65	55	70
Portland Elec. Pwr., com.	33	22	30
Potomac Elec. Power, pf., ex. div.	m111½	....	....
Pwr. Sec., pf.—no par.	50	40	56
Pwr. Sec., com.—no par.	k 12	5	15
Public Serv. of Colorado, 7% pf.	*104	99	103
Pub. Serv. of N. J., 6% pf.	103½	98½	105
Pub. Serv. of N. J., 8% pf.	k134	125	135½
P. S. of N. J., $2 com.—no par.	44	32	46½
Pub. Serv. of No. Ill., 6% pf.	a111½	101½	111½
Pub. Serv. of No. Ill., 7% pf.	a119½	112½	119½
P. S. of No. Ill., com. $8—no par.	a157	140½	158
Pub. Serv. of No. Ill., $8 com.	a158	132	161½
Pub. Serv. of Okla., 7% pr. in.	102	90	103
Pub. Serv. Elec. & Gas, 6% pf.	110½	102	110½
Puget Sound Pwr. & Lt., 7% pr. pf.	110½	103½	111
Puget Sound Pwr. & Lt., $6 pf.—no par	92	83½	92
Puget Sound Pwr. & Lt., com.	36	29½	38
RADIO CORP. OF AMER., $3.50 pf.—50.	57	49	57
Radio Corp. of Amer., com.—no par.	98½	41½	98½
Rochester Gas & Elec. 6% pf. D.	105	101	103½
Rochester Gas & Elec., 7% pf. B.	105½	105	107
Rochester Gas & Elec., 6% pf. C.	104½	101½	103½
SAFETY CABLE, com. $4.	k 58	52½	74½
San Joaquin Lt. & Pwr., 7% pr. pf.	111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	75	70	75
Servel Corp.	10cts	10cts	10½
Sierra Pacific Elec., 2% com.	m 29	24½	31½
Sioux City Gas & Elec., 7% pf.	105½	99	105½
Southeastern Pwr. & Lt., pf.—$7 no par	*109½	....	....
Southeastern Pwr. & Lt., pfc. pf.	f 85	....	....
Southeastern Pwr. & Lt., com.—no par	44	29½	46
So. Calif. Edison, 8% pf.	40	36½	40
So. Calif. Edison, 7% pf.	k 28½	27	28½
So. Calif. Edison, 6% pf.	25½	24½	26½
So. Calif. Edison, 8% com.	40½	31½	41
Southern Cities Utilities, 7% pf.	k 74	67	90½
Southern Cities Utilities, com. $4.	m 32½	31	42½
Southwestern Lt. & Pwr., A $3.	65	60	65
Southwestern Lt. & Pwr., B.	65	60	65
Southwestern Lt. & Pwr., $6 pf.	87	83	91½
Southwestern Pwr. & Lt., 7% pf.	111½	104	115
Springfield (Mo.) Ry. & Lt., 7% pf.	102	95	102
Standard Gas & Elec., 8% pf.	66	57½	66½
Standard Gas & Elec., 7% pr. pf.	109½	103	112
Standard G. & E., com. $3.50—no par	62½	54	65½
Standard Power & Light, com.	31	22	32
Standard Pwr. & Lt., 7% pf.	102½	98	102½
Staten Island Edison, pf.—$6—no par	100	99	101
Superheater, $6 com.—no par.	171	....	....
Syracuse Lighting, 7% pf.	110	103	107
Syracuse Lighting, 8% pf.	117½	....	
TAMPA ELEC., com. $2.	63	....	....
Tenn. Elec. Pwr., 6% pf.	101	92	100
Tenn. Elec. Pwr., 7% pf.	108	103	109
Terre Haute, Ind. & East. Trac., 5% pf.	26	20	30
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	*113	104	112
Tide Water Pwr., 8% pf.	109	105	110
Timken Roller Bear., com.—$4 no par.	129	78	142½
Toledo Edison, 7% pf.	*109	102	107
Toledo Edison, 6% pf.	k100	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	96½	96	99
UNITED GAS & ELEC., 6% pf.	101	98	102
United Gas & Elec. (N. J.) 5% pf.	73	70	75
United Gas Impr., 8% com.—50.	c110½	89½	118½
United Lt. & Pwr., pf.—$4—no par.	k 53	49	55
United Lt. & Pwr., pf.—$6.50—no par	94½	87	97½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	a 19	15	24
Utah Pwr. & Lt., 7% pf.	*109	104	108½
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	97½	93	100
Utilities Pwr. & Lt., com. A $2.	30½	27	34
Utilities Pwr. & Lt., com. B $1—no par	22½	13½	23½
VERMONT HYDRO-ELEC., 7% pf.	97	95	100
Virginia Elec. & Pwr., 7% pf.	108	105	110
Virginian Pwr., 7% pf.	m108	....	....
Virginian Pwr., com.	75	....	....
WAGNER ELEC., 7% pf.	b 87	68	90
Wagner Elec., com.—no par.	b 31	18½	39½
Washington Ry. & Elec., 5% com., ex. div.	442	..	....
Washington Ry. & Elec., 5% pf., ex. div.	98	..	....
Washington Wtr. Pwr., 8% com.	167	136	182
West Penn Elec., 7% pf.	111	102	112½
West Penn Elec., Cl. A $7.	k108	97½	111
West Penn Pwr., 7% pf.	117	111	118
West Penn Pwr., 6% pf.	k107½	100½	109
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	103½	98	103½
Western States Gas & Elec., 7% pf.	104½	96	105
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	91½	67½	92½
Weston Elec. Instrument, Cl. A $2 —no par.	k 31	30	34½
Weston Elec. Instrument, com.—no par.	14½	11	18½
Wheeling Elec., 6% pf.	103	95	104
Worthington Pump, 7% pf. A.	k 46	46	61½
Worthington Pump, 6% B.	45½	37	54½
Worthington Pump, com.	29½	20½	46
YALE & TOWNE com. $5—25.	74	70½	84½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Nov. 26. *Bid price Wednesday, Nov. 30. mLatest quotations available. †Dividend rate variable.

NEW YORK UTILITY REDUCES SHARES.—The New York Central Electric Corporation has filed a certificate in the office of the Secretary of State reducing the number of shares of its hundred-dollar par value stock from 100,000 to 70,000.

COMMONWEALTH POWER STOCKHOLDERS TO SUBSCRIBE TO ADDITIONAL SHARES.—The board of directors of the Commonwealth Power Corporation at a meeting held on Nov. 15 adopted a resolution directing that common-stock holders of record at the close of business on Nov. 25 be offered the right to subscribe to additional common stock at $56 per share to the extent of one-tenth of their holdings. Subscription rights will expire Dec. 16. The sale of the additional common stock will raise funds for the purchase of additional common stocks in its subsidiary companies, which companies in turn will use the funds for additions and extensions to their plants and distribution systems.

AMERICAN SUPERPOWER TO AFFILIATE WITH UTILITY SHARES CORPORATION.—American Superpower Corporation is planning to affiliate with the Utility Shares Corporation by exchanging one share of American Superpower B common stock for three shares of Utility Shares common stock. The exchange offer is open to Utility Shares stockholders of record Nov. 12 and it expires Nov. 26.

EXTRA DIVIDENDS.—The Pennsylvania Gas & Electric Corporation declared an extra dividend of 3¾ cents and regular quarterly dividend of 37½ cents on class A, 1¾ per cent on 7 per cent preferred and $1.75 on no par preferred. The American Superpower Corporation declared an extra dividend of one-fiftieth of a share in class A common stock on class A and class B common, and the regular quarterly dividend of 30 cents in cash on the class A and class B common. The directors also declared the $1.50 dividend on the first preferred stock of the company, all these dividends being payable Jan. 1 to stock of record Nov. 30.

SOUTHERN CITIES COMPANY COMPLETES CAMPAIGN.—The Southern Cities Utilities Company recently completed a successful twelve-day customer-ownership campaign in which applications for more than 2,500 shares of its six-dollar prior preferred stock were received from approximately 750 customers by the employees of its subsidiary properties in Tennessee and Alabama.

Business News and Market Conditions

Electrical Exports Ahead of Same Period Last Year

Electrical equipment exports from the United States in September reached a value of $8,233,537. The total of $73,379,472 for the first nine months of this year is $909,714 higher than the total for the same period last year, according to the electrical equipment division of the Department of Commerce. Exports for the month of September were lower than those of the same month last year by about $1,200,000. Substantial increases were noted for switchboard panels, except telephone, and other telephone equipment, electrodes for electric furnaces and portable electric tools. Large decreases were recorded for batteries, rectifiers, double-current generators and motor-generators, dynamotors, synchronous and other converters, stationary motors, railway motors, electric motors, radio apparatus, electric lamps, bare copper wire and insulated copper wire and cable. The largest two important decreases were registered in shipments of bare copper wire and also for insulated copper wire and cable. The latter showed a decrease of $243,639, while the former declined $154,003, as compared with September last year.

The value of exports of electric lamps during September decreased $102,768 and the value of batteries $68,150. Exports of electric fans decreased $25,949, and domestic heating and cooking devices registered a $24,056 loss for the month of September, 1927, as compared with the same month last year, although up to this time these commodities have shown a rather consistent gain. Motor-driven household devices remained fairly steady and showed a small gain of $103.

Maritime Compensation for Land Workers

Tradesmen who occasionally work aboard vessels were provided with compensation rights in the longshoremen's and harbor workers' compensation act, effective July 1 of this year. Firms who send men aboard vessels are not covered by the state compensation law. Employers subject to the law, no matter how infrequently their men work aboard vessels, are required to carry insurance protection either with an authorized carrier or by obtaining from the commission a permit to self-insure. The administration of this act is intrusted to the United States Employees' Compensation Commission, Washington, D. C. The country has been divided into fourteen districts with offices in the following cities: Boston, New York, Philadel-

Value and Destination of Electrical Exports for September, 1927, Compared with Corresponding Month in 1926

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	September 1926	September 1927
Generators:		
Direct-current:		
Under 500 kw.	$98,067	$67,426
500 kw. and over	46,588	82,544
Alternating current:		
Under 2,000 kva.	19,448	10,627
2,000 kva. and over	226,121	84,769
Steam turbo-generator sets	146,660	156,328
Accessories and parts for generators	64,836	79,455
Self-contained lighting outfits	80,937	96,055
Batteries:		
Flashlight batteries	208,075	162,317
Other primary batteries	164,832	161,721
Storage batteries	293,061	273,777
Transforming or converting apparatus:		
Power transformers	200,578	140,568
Other transformers	112,762	46,554
Rectifiers, double-current and motor-generators, dynamotors, synchronous and other converters	352,136	82,812
Transmission and distribution apparatus:		
Switchboard panels, except telephone	100,262	420,532
Switches and circuit breakers over 10 amp.	205,190	188,145
Fuses and fuse blocks	32,858	36,579
Watt-hour and other measuring meters	26,342	22,269
Volt, watt and ampere meters and other recording, indicating and testing apparatus	238,402	208,783
Lightning arresters, choke coils, reactors and other protective devices	61,111	70,598
Motors, starters and controllers:		
Motors under 1 hp.	177,140	206,034
Stationary motors:		
1 to 200 hp.	$311,267	$201,813
Over 200 hp.	98,170	18,516
Railway motors	205,652	63,213
Electric locomotives:		
Railway	349,505	190,172
Mining and industrial	98,438	37,103
Starting and controlling equipment for:		
Industrial motors	128,380	82,344
Electric railway and vehicle motors	18,896	67,674
Portable electric tools	33,864	72,971
Accessories and parts for motors	204,339	167,740
Electric appliances:		
Electric fans	78,977	53,028
Electric lamps:		
Metal filament	152,022	91,081
Other electric lamps	22,301	37,635
Flashlights	179,715	155,861
Searchlights and projectors	53,868	20,561
Motor-driven household devices	198,539	198,642
Domestic heating and cooking devices	151,270	127,214
Industrial electric furnaces and ovens	10,205	56,305
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	106,155	147,830
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	5,701	64,768
Receiving sets	351,994	246,239
Tubes	77,599	81,517
Receiving set components	227,163	197,474
Receiving set accessories	262,416	247,866
Telegraph apparatus	94,001	153,367
Telephone apparatus:		
Telephone instruments	35,225	27,143
Telephone switchboards	19,900	14,318
Other telephone equipment	$166,556	$280,191
Railway signals, switches and attachments	36,158	42,221
Bells, buzzers, annunciators and alarms	19,313	23,682
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	181,913	147,728
Insulating material	137,615	67,070
Metal conduit, outlet and switch boxes	83,439	74,830
Sockets, receptacles and lighting switches	156,194	135,228
Electric lighting fixtures, interior and street	159,857	136,301
Other wiring supplies and line materials	81,549	158,394
Other electrical apparatus, not elsewhere stated	686,543	446,913
Rubber and friction tape	34,723	27,249
Globes and shades for lighting fixtures	61,856	43,921
Electrical glassware except for lighting	35,185	19,017
Electrical porcelain:		
For less than 6,600 volts	79,359	45,896
For 6,600 volts and over	79,759	41,778
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	108,008	149,529
Other carbon products	126,734	116,319
Insulated wire and cable (iron and steel)	17,828	14,801
Copper, bare wire	265,335	111,332
Copper, insulated wire and cable	504,754	361,115
Refrigeration sets up to 1-ton capacity	*	284,737
Domestic washing machines	76,420	84,997
Total	$9,430,066	$8,233,537

*Not collected in 1926.

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	Sept., 1927
EUROPE	$1,298,404
Belgium	48,641
France	99,983
Germany	99,998
Italy	96,162
Netherlands	43,379
Spain	202,540
United Kingdom	459,640
Other countries	248,061
WESTERN HEMISPHERE	$4,917,350
Canada	1,977,307
Mexico	372,580
Cuba	354,761
Argentina	492,929
Brazil	800,602
Chile	161,166
Colombia	173,319
Peru	43,846
Venezuela	169,018
Other countries	371,822
ASIA, AFRICA AND OCEANIA	$2,017,783
British India	135,972
China	87,265
Japan	667,537
Philippine Islands	160,708
Australia	472,131
New Zealand	114,695
British South Africa	132,689
Other countries	246,786

phia, Baltimore, Norfolk, Savannah, New Orleans, St. Louis, Chicago, Cleveland, Louisville, Galveston, San Francisco and Seattle.

Lamp Sales Largest on Record

Sales of incandescent lamps during 1927 are estimated to reach a total of about 320,000,000 large and 218,000,000 miniature lamps. This represents an increase of about 8,000,000, or 2½ per cent, in large lamps and about 16,000,000, or 8 per cent, in miniature lamps over the year 1926. The sales are the largest in the history of the industry. The sale of large lamps is about 75 per cent greater and miniature lamps about 200 per cent greater than the sales of ten years ago.

Canadian Electrical Code Rules Published

The Canadian electrical code which was adopted as the result of a meeting of representatives of all the Canadian provincial governments at Winnipeg on June 15 to 20, as announced in the July 23 issue of the ELECTRICAL WORLD, has been published by the Canadian Engineering Standards Association, Ottawa, Canada. The rules are published in a handy pocket-sized book form. The established code covers the essential requirements and minimum standards for Canadian electrical installations in, on or over buildings using potentials up to 5,000 volts.

Market Conditions

VIRTUALLY throughout the country business in the electrical industry is regarded as in good volume. There has been an indication of delay in ordering in some cases, but many projects are active and equipment orders will undoubtedly be placed at an early date. Reports from the Vacuum Cleaner Manufacturers' Association show sales during the third quarter of the year to be 212,829, as compared with 216,148 during the corresponding quarter last year.

In New England there is a tendency to postpone orders. Negotiations are under way for a number of turbo-generators and the demand for electric furnaces is gaining. There is an improved call for equipment in the Eastern district, transformer sales are good, and industrial business shows a decrease. On the other hand, industrial plant buying is active in the Southeast and several electrification projects have been announced. The outlook for December is promising in the Middle West. A municipal order for $115,000 worth of wires and cables was placed. On the Pacific Coast power-company purchasing has covered varied machinery requirements. Several industrial plant orders are anticipated by the end of the year.

Copper and Lead Prices Advance in Active Market

Sales of virtually all metals have been phenomenally good in November. Prices of copper, tin, lead, zinc and silver have advanced as a result. Copper has done particularly well, advancing ⅜ cent during the month. Lead and zinc dropped to new lows early in November but have since more than made up the loss. Until recently manufacturers have been buying metal only from hand to mouth, but more of an inclination to buy for forward delivery is now manifest as they seem assured of a good demand for their products during the winter and early spring.

NEW YORK METAL MARKET PRICES

	Nov. 23, 1927 Cents per Pound	Nov. 30, 1927 Cents per Pound
Copper, electrolytic	13⅜	13⅜
Lead, Am. S. & R. price	6¼	6.425
Antimony	10¼	10⅜
Nickel, ingot	35	35
Zinc spots	6.20	6.20
Tin, Straits	58	58¼
Aluminum, 99 per cent	25	25

Base copper price Nov. 30, 1927, 15¼ cents.

New England Buying Shows Tendency to Decrease

A quiet tone in buying and a general tendency to postpone the placing of orders marked the electrical market in the New England district. Heavy equipment is less active, small motor sales have dropped off, and central-station supplies show a sag in the sales volume as compared with previous weeks. Negotiations are under way for a number of turbo-generators, and the demand for electric furnaces is gaining. A manufacturer records a steady movement in small power apparatus equipment and a fair demand for small switches and control equipment. A good trend in meter sales is reported. Wiring devices are moving, though jobbers as a rule report spotty conditions. Oil-burning equipment sales are outstanding among appliances, with electric refrigerators gaining in popularity. A number of large-lot orders of the latter are interesting.

Projects in view in the district consists of a number of large wiring contracts. The Boston Homœopathic Hospital is planning for a new unit. The Deer Rips power plant of the Central Maine Power Company plans to develop an additional 5,500 hp., using one unit. The Boston & Maine Railroad, Boston, is planning the electrification of its proposed freight car repair shops at Concord, N. H. The Transit Department, Boston, will construct a one-story and basement power substation on Beale Street, Dorchester, Mass. The United Illuminating Company, New Haven, Conn., is arranging an early call for bids for a proposed new power plant to cost in excess of $2,000,000.

Improved Call for Equipment in Eastern District

Heavy electrical equipment shows signs of revival in the New York market, and one of the leading manufacturers reports business in this line as exceeding that of smaller apparatus. Inquiries indicate an upward trend in this direction, with a number of excellent prospects now in sight for early commitment, covering generators and auxiliary machinery, as well as heavy-duty motors of sizable capacities. Line equipment is developing a better share of attention, and prospects appear brighter for a higher rate of business than in several weeks past. Contracts will soon be placed for considerable heavy electrical machinery for Russian interests and will include equipment for mining machinery service.

Industrial business shows a tendency to slacken, and the majority of orders coming from this source are of rather minor extent. Wiring materials both for industrial and domestic service are enjoying a fair demand. Sales of electric refrigerators are exceeding those of a year ago. Transformer business is reported good by a prominent manufacturer. Although 1927 business as a whole is a little below that of a year ago, improved call is being evidenced from week to week with respect to actual orders as well as inquiries. This manufacturer says that present bookings insure continuous production on a close to normal level during the winter months. Manufacturers and distributors at Philadelphia are not noticeably encouraged by the present trend and report orders on a reduced basis, although inquiries are showing an increase in volume. Some improvement is shown in the local textile and leather industries. The latter bids fair to reach peak proportions in the immediate future. The outlook for substation equipment has improved.

Current construction in the Eastern district includes the following: The Quartermaster, Governor's Island, New York, is asking bids until Dec. 6 for Diesel electric generators and for an electric power and lighting system. The Southern Sugar Company, 342 Madison Avenue, New York, has plans for a large cane-sugar refining plant at Clewiston, Fla., to cost about $1,000,000. The Wright Aeronautical Corporation, Paterson, N. J., will build a new addition to cost about $200,000. The Public Service Gas & Electric Company has plans maturing for a switching station in the vicinity of Metuchen, N. J. Officials of the Pennsylvania Power & Light Company, Allentown, Pa., have formed a group of nine subsidiary utilities to construct and operate transmission lines in Juniata, Snyder, Northumberland and Perry Counties. The

Metropolitan Edison Company, Reading, Pa., also has organized three subsidiary transmission line companies to operate transmission lines in McNett, McIntyre and Lewis Townships, all in Lycoming County. The Bethlehem Shipbuilding Corporation, Baltimore, will take bids at an early date for a new unit at its plant to cost nearly $1,000,000.

Construction Plans for the St. Louis District

Construction projects in the St. Louis district are as follows: Campbell, Mo., will soon take bids for the construction of a municipal electric light and power plant, to cost in excess of $50,000. The Kansas State Agricultural College, Manhattan, Kan., is asking bids until Dec. 15 for the construction of a new power plant to cost $300,000. Chickasha, Okla., plans the installation of an ornamental lighting system in the business district, to cost about $50,000. Oklahoma City, Okla., is planning to install an ornamental lighting system on Grand Avenue, from Broadway to Walker Avenue. The Valley Electric & Ice Company, Brownsville, Tex., plans to construct a one-story power plant and an ice-manufacturing plant. Fort Worth, Tex., plans an ornamental lighting system on Page Street and College Avenue. San Antonio, Tex., plans extensions in the municipal ornamental lighting system. The Central Power & Light Company, San Antonio, Tex., plans the construction of an ice-manufacturing and cold-storage plant at Brownsville, Tex., to cost about $200,000. Monroe, La., is planning extensions in the municipal electric power plant, to cost about $125,000.

Outlook for December Promising in Middle West

Little change in business is noted in the Middle West. Present indications point to a favorable closing of the month and the outlook for December is promising. Reports from the steel industry indicate a slight increase in production, and this in conjunction with reports of large equipment purchases by the railroads tends to further the optimistic feeling. Industrial activity is improving and general conditions are fairly good. The various utility companies are continuing their construction programs and maintenance purchasing is adding materially to the improvement in general trade conditions. Interesting inquiries include 38,000 tons of condenser tubes and a large quantity of lead-insulated and paper-insulated cables for 1928 requirements. An order was placed for two 5,000-amp., 600-volt rectifier units and for constructing the foundations for a 208,000-kw. turbo-generator unit. Jobbers' sales continue to increase. Considerable municipal business is being obtained, one item of particular note being an order for wires and cables valued at $115,000.

Construction projects are as follows: The South Park Commissioners, Chicago, plan to install an ornamental lighting system on the lake front from Twenty-third to Thirty-first Street, and from Fifty-first to Fifty-seventh Street. Alexandria City, Minn., is asking bids until Dec. 14 for extensions and improvements in the municipal power plant, to cost $75,000. The Otter Tail Power Company, Fergus Falls, Minn., has permission to construct a transmission line from Jamestown to Edgeley and from Cooperstown to Binford, N. D. The Montana-Dakota Power Company, Minneapolis, Minn., is concluding negotiations for the purchase of the municipal electric system at Williston, N. D., for about $80,000 and plans extensions in transmission lines. The Nebraska Gas & Electric Company, Lincoln, Neb., plans to erect a transmission line from its Holmesville hydro-electric power plant to Humboldt and vicinity. The Nebraska Light & Power Company, McCook, Neb., plans extensions and improvements in transmission and distributing lines to cost about $50,000. West Point, Neb., plans to construct an addition to the municipal electric power station. Ames, Iowa, plans to install an ornamental lighting system on Main Street. The Iowa-Nebraska Light & Power Company plans to rebuild its transmission lines from Coin to Shenandoah, and from Avoca to Shelby, Iowa, to cost about $30,000. The Northern Utilities Corporation, Starkweather, N. D., will build a transmission line to serve Cleveland, N. D.

Industrial Business Active in Southeast

There are few large orders being placed for electrical equipment in the Southeast, although the volume is satisfactory. The largest order placed was for power transformers amounting to $75,000, while the next order in point of size was for $14,000 worth of oil circuit breakers. One power company ordered approximately $13,000 worth of transformer coils and parts for repair work and $4,500 worth of creosoted pine poles and miscellaneous wiring supplies. The only other order of any size was for a waterwheel generator approximating $4,000 in value. There is oil-switch business to the extent of more than $150,000 in immediate prospect, and orders will undoubtedly be placed within the coming week.

Several electrification projects have been announced, the largest being a plant for manufacturing hardware supplies and involving more than $12,000 worth of electrical equipment. A small marble quarry in Georgia has undertaken electrification work calling for $5,000 worth of electrical materials and equipment, while a cotton mill in the same state with electrification under way let a contract for $10,000 covering mill and village lighting. An abattoir in this section is enlarging its plant and putting in a new electric refrigeration system costing $12,000. Orders were placed for approximately $4,000 worth of electrical materials for the Elizabeth Bartlett Mills at Acworth, Ga. This is a new plant of 24 looms for the manufacture of draperies and tapestries.

The Georgia Power Company has purchased the municipal electric distribution system in McRae and will construct approximately 11 miles of 44,000-volt transmission line and install a 450-kva. substation at McRae. Other construction projects include: Cookeville, Tenn., is planning for an addition to its municipal hydro-electric power plant, to cost about $200,000. Birmingham, Ala., contemplates the installation of an ornamental lighting system in the Five Points district. The Florida Cold Storage Company, Orlando, Fla., plans the construction of new cold-storage and ice plants at Sanford and Orlando, each to cost about $350,000.

Varied Power-Company Buying on Pacific Coast

Power-company purchases on the Pacific Coast have included several orders for varied machinery such as eight large motors, valued at $16,000, for an Oakland (Cal.) auxiliary steam station. A northern California company has ordered $10,000 worth of outdoor substation apparatus and $12,000 worth of 66,000-volt lightning arresters for Sierra service. Other power-company purchases have included $4,000 worth of high-tension varnished-cambric lead cable, a four-thousand-dollar switchboard for Nevada, a carload of conduit, 130 35-ft. poles, butt-treated, and two carloads 55-ft. butt-treated poles. Miscellaneous business has included a 125-hp. motor for construction work, $1,000 worth of trolley wheels for a Sierra lumber company, $2,500 worth of fiber conduit and small transformers and wiring material for a government job. An inquiry was placed for 250,000 ft. No. 12 single-braid solid rubber-covered wire for an educational institution. Manufacturers report business rather quiet, particularly in machinery, although it is expected that several hydro-electric plants now being projected will ripen into excellent prospects by spring. Jobbers report a very fair November business, although holiday sales strictly as such have not yet materialized in any great amount.

Business in the Puget Sound district is light and scattered, although inquiries are being received from pulp and paper mills and sawmills and indications are bright. Several big deals for pumps, motors and other electrical apparatus are still pending, with awards scheduled to be made before the first of the year. The Pacific Power & Light Company plans changing a 22,000-volt power line to 66,000 volts, using a new location, and is completing surveys. The West Canadian Hydro-Electric Corporation, Ltd., Vancouver, B. C., plans immediate construction of a dam and power house with a capacity of 2,200 hp., and the town of Chehalis is calling for bids for the construction of a municipal power transmission line to Morton from La Grande, for which $60,000 worth of bonds have been voted.

Other construction projects are as

follows: The Kern River Ice Company, Bakersfield, Cal., plans the construction of a 50-ton ice-manufacturing plant. The Imperial Linen Mills, Chula Vista, Cal., will install electric power equipment in a proposed one-story addition, to cost about $200,000. Albany, Ore., is planning to install an improved street-lighting system on all important streets. The Deschutes Power & Light Company, Bend, Ore., plans to erect a transmission line from its Cove power plant to Redmond. The Puget Sound Power & Light Company, Seattle, has applied for permission to construct a transmission line in the Curtis district, near Chehalis, Wash. The Western Wool Exchange, Parowan, Utah, will install electric power equipment in its proposed wool plant, to cost in excess of $300,000.

Activities of the Trade

Locke Insulator Corporation Denies Merger

The rumor published in the ELECTRICAL WORLD last week to the effect that there had been a merger of the Ohio Brass Company and the Locke Insulator Corporation has been denied. F. H. Reagan, president of the Locke Insulator Corporation, stated to the ELECTRICAL WORLD that no merger had been made and that the ownership of the Locke corporation has been unchanged since 1921.

W. J. Myers Appointed Receiver of Robbins & Myers

Wilbur J. Myers has been appointed receiver of the Robbins & Myers Company, Springfield, Ohio, following an application for a receivership made after a meeting of the board of directors. Mr. Myers made the following statement:

"For some time plans for reorganization of the Robbins & Myers Company have been considered, and as a part of any reorganization a receivership is necessary. It is hoped that the receivership of the company will be ultimately helpful rather than hurtful to the business of the company. The company's fixed charges for bond and other interest have been too heavy for its resources. Its good will and trade have been extensive, and we hope they will continue and that a reorganization may develop. The company owes no money in Springfield, the creditors being outside banks and firms. All payroll checks will be paid. It is hoped that creditors and security holders will work together for a favorable outcome, and the employees and staff of the company can be counted on to give their best efforts to that end."

THE COOPER HEWITT ELECTRIC COMPANY announces the removal of its general offices to its new building at 410 Eighth Street, Hoboken, N. J.

THE MORSE CHAIN COMPANY, Ithaca, N. Y., announces the appointment of Harry E. Matthews as manager of the Charlotte (N. C.) office. The managership in the Charlotte office became vacant with the death of George W. Prichett on Sept. 15. Mr. Pritchett had been manager of that office since its opening. Mr. Matthews has been assistant manager of the Charlotte office for about eight years.

THE W. N. MATTHEWS CORPORATION, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, has announced price changes on its "Fuswitches" and quick release slack pullers.

THE NAUGLE POLE & TIE COMPANY (Delaware) has recently been incorporated for the purpose of acquiring and continuing the business of the Naugle Pole & Tie Company of Illinois. An offering of $750,000 worth of 7 per cent cumulative sinking-fund preferred shares has been made by the Delaware company for the purpose of purchasing the properties and business of the Illinois company.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., is now offering a new type of single-fused unit panelboard having lugs in the mains and tumbler switches and plug fuses in the branches.

THE R. H. BEAUMONT COMPANY, 319 Arch Street, Philadelphia, announces that George T. Birch, recently connected with the home office, has been transferred to the Detroit office, 901 Kresge Building, and will act as district manager of that territory.

THE WESTERN ELECTRIC COMPANY has filed plans for the erection of a new unit at its plant at Kearny, N. J. The new plant will be a one-story building, 97 ft. by 346 ft.

THE STEINMETZ HEATING COMPANY, INC., 30 Church Street, New York, has been appointed exclusive representative for Dover electric irons and percolators as made by the Dover Manufacturing Company, Dover, Ohio, for Japan, Spain, Portugal, Uruguay and Argentina. The company has also been appointed exclusive representative for the electric table stoves and ranges made by the Armstrong Manufacturing Company, of Huntington, W. Va., for Japan, Spain and Portugal. George E. Willard of Buenos Aires, representative for Uruguay and Argentina for many years for the Trumbull Electric Manufacturing Company and the Robbins & Myers Co., has been appointed a representative for the Steinmetz company in the same countries, and the Nankoku Company, Ltd., of Tokyo, Japan, has also been appointed a representative for the Steinmetz company in Japan, Korea and Manchuria.

THE EUREKA VACUUM CLEANER COMPANY, Hamilton and Dewey Avenues, Detroit, has increased its production to 1,500 cleaners per day. This is an increase of 50 per cent over the production rate of 1,000 cleaners per day maintained during the first half of the year.

THE CLARK CONTROLLER COMPANY, 1146 East 152d Street, Cleveland, is said to be considering the erection of a new one-story addition.

THE YALE ELECTRIC CORPORATION, Pearl and Tilary Streets, Brooklyn, N. Y., manufacturer of flashlights and dry batteries, announces that its million-dollar plant in Jersey City, N. J., is nearly completed. The building comprises six stories, with a floor space of over 400,000 sq.ft.

THE HAZARD MANUFACTURING COMPANY, Wilkes-Barre, Pa., manufacturer of electrical wires and cables, announces that its Chicago office has been moved to 1840-1842 Midland Building, 168 West Adams Street, Chicago. The New York office of the company also has been moved to Room 3008, Transportation Building, 225 Broadway. Both the Chicago and New York offices and warehouses of the Hazard Wire Rope Company are now separate and distinct from the Hazard Manufacturing Company. The Chicago office will be retained at 32 South Clinton Street, Chicago, and the New York office at 533 Canal Street, New York City.

THE EUREKA VACUUM CLEANER COMPANY, Detroit, announces a new floor-polishing attachment as auxiliary equipment for the model 10 Eureka vacuum cleaner.

THE M. S. WRIGHT COMPANY, Worcester, Mass., has placed on the market the "Brush-Vac" cleaner with a motor-driven brush. The unit retails at $44.50 and the attachments are $5 per set.

THE G & W ELECTRIC SPECIALTY COMPANY, 7780 Dante Avenue, Chicago, has appointed Clovis M. Converse sales engineer. Mr. Converse was formerly manager of the power apparatus department of the St. Paul Electric Company at St. Paul (now the Great Northern Electric Appliance Company.)

THE HENDRICK MANUFACTURING COMPANY, Carbondale, Pa., manufacturer of "Mitco" interlocked steel floor grating, etc., announces the appointment of the following representatives: J. E. Beattie, Greenville, S. C.; the Boiler Equipment Service Company, Candler Building, Atlanta; the Latex Steel & Machinery Company, San Jacinto Life Building, Beaumont, Tex., and the W. A. Sedwick Company, 401 Construction Building, Dallas.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 8, 1927

1,648,518. ELECTRICAL CONNECTER; W. S. Werner, Covington, Ky. App. filed July 28, 1924. Adapted to connect X-ray tubes in high potential circuits.

1,648,560, 1,648,561, 1,648,562, 1,648,563. ELECTRIC ARC WELDING; H. D. Morton, New York, N. Y. Apps. filed Jan. 27, 1917, Dec. 2, 1918, and Aug. 20, 1927. In which a metallic electrode in the form of a strip or wire of welding material is fed to the arc and to the work which constitutes the other electrode in the circuit.

1,648,564. MAGNETO-ELECTRIC MACHINE; M. A. Pattay and E. Jaquemot, Geneva, Switzerland. App. filed Dec. 8, 1925. Used for pocket lamps.

1,648,582. ELECTRIC OUTLET; W. W. Dodge, Jr., Asheville, N. C. App. filed June 28, 1924. A cable-retracting outlet.

1,648,588. ELECTRICAL WATER-HEATING UNIT; M. Nerew, Hayden, Ariz. App. filed June 11, 1925.

1,648,606. INSULATING SWITCH SHELL; T. A. Both, Stratford, Conn. App. filed March 26, 1923.

1,648,629. TRAFFIC REGULATION SYSTEM; E. S. Taylor and H. E. Young, Chicago, Ill. App. filed Aug. 13, 1925.

1,648,641. ELECTRIC CABLE; H. W. Fisher, Perth Amboy, N. J. App. filed Jan. 27, 1927. Oil-filled, paper-insulated cable.

1,648,674. ELECTROMAGNETIC DEVICE; E. R. Carichoff, Schenectady, N. Y. App. filed Dec. 18, 1922. Operating electromagnet for electric switches.

1,648,677. INCANDESCENT ELECTRIC LAMP; J. H. de Boer, Eindhoven, Netherlands. App. filed Nov. 2, 1926. Comprising a tungsten filament and a sealed bulb having a salt of hydrofluorboric acid distributed in it to hinder absorption of the light by vaporized tungsten.

1,648,678. COMPOSITE METAL ARTICLE; W. Ehlers, Berlin, Germany. App. filed Jan. 18, 1926. Made up of closely compacted spindle-shaped particles of metal.

1,648,679. INCANDESCENT LAMP; G. R. Fonda, Schenectady, N. Y. App. filed Jan. 18, 1921.

1,648,680. ELECTRIC MOTOR CONTROL FOR FEED MECHANISMS; R. D. Given, Leamington, England. App. filed Jan. 29, 1927.

1,648,683. ARC WELDING; G. T. Herald. Westfield, N. J. App. filed Oct. 25, 1924. Backing member arranged to prevent the rapid abstraction of heat from the parts while they are being welded together.

1,648,684. ELECTRIC SWITCH; E. M. Hewlett and W. K. Rankin, Schenectady, N. Y. App. filed Aug. 15, 1921. Oil switch in which pressure created by the arc at the opening of the switch is utilized to create a blast of oil which is directed into the path of the arc and serves to extinguish the same.

1,648,686. METER SEAL; C. E. Holmes, Lynn, Mass. App. filed Dec. 1, 1926.

1,648,688. BRUSH-SHIFTING ARRANGEMENT FOR DYNAMO-ELECTRIC MACHINES; J. I. Hull, Schenectady, N. Y. App. filed Jan. 16, 1926.

1,648,690. METHOD OF MAKING LONG-CRYSTAL TUNGSTEN FILAMENTS; R. Jacoby, Berlin, Germany. App. filed April 19, 1924.

1,648,694. GROUNDING ARRANGEMENT; E. G. Merrick, Schenectady, N. Y. App. filed April 30, 1927.

1,648,698. BRUSH-SHIFTING DEVICE FOR ALTERNATING-CURRENT MOTORS; H. Schrage, Paris, France. App. filed June 5, 1924.

1,648,700. THERMAL ELECTRIC GENERATOR; D. T. Simonds, Schenectady, N. Y. App. filed March 31, 1925.

1,648,704. ELECTRICAL FIXTURE; J. A. Volk, Jr., Norwalk, Conn. App. filed Aug. 1, 1922. Adapted to be used as an outlet box or a junction box.

1,648,705. ELECTRICAL APPARATUS CORE; E. A. Wagner, Pittsfield, Mass. App. filed April 3, 1927.

1,648,707. INDUCTION FURNACE; J. M. Weed, Scotia, N. Y. App. filed Dec. 14, 1923.

1,648,739. APPARATUS FOR MEASURING ION CONCENTRATION; E. Mislowitzer, Berlin, Germany. App. filed Nov. 7, 1925.

1,648,741. ELECTRIC OPERATING MECHANISM; C. L. Perry, Schenectady, N. Y. App. filed March 5, 1924. For operating a switch.

1,648,752. THERMOSTATIC CIRCUIT CLOSER; H. M. Baldwin and H. M. Trenor, Gary, West Va. App. filed Sept. 30, 1922.

1,648,764. RENEWABLE FUSE ATTACHMENT PLUG; F. F. Frakes, Columbia, Tenn. App. filed Jan. 21, 1926.

1,648,805. RECEPTACLE; M. Guett, Hartford, Conn. App. filed June 5, 1924.

1,648,848. HYDRAULIC WORKS UTILIZING THE POWER OF TIDES; A. Huguenin, Paris, France. App. filed March 16, 1927.

1,648,853, 1,648,854. ELECTRIC SWITCH; M. P. Luther, Chicago, Ill. Apps. filed Nov. 23, 1921. Safety type.

1,648,871. RESISTOR; G. H. Whittingham, Baltimore, Md. App. filed Nov. 29, 1926.

(Issued Nov. 15, 1927)

1,648,887. CONNECTER FOR ELECTRIC CONDUCTORS; R. C. Armen, Rochester, Pa. App. filed Oct. 28, 1925.

1,648,898. COMMUTATOR ELECTRICITY METER; J. Harris, Lafayette, Ind. App. filed Sept. 18, 1924. Means for overcoming the errors in torque which arise from either or both the heat generated by the current flowing in the meter windings and that present in the surroundings.

1,648,909. SWITCHING MECHANISM FOR REELS FOR ELECTRIC CONDUCTORS; A. E. F. Moone, Chicago, Ill. App. filed Nov. 9, 1923.

1,648,914. STORAGE-BATTERY POST CLAMP; J. W. Roy, Detroit, Mich. App. filed June 30, 1924.

1,648,915. ELECTRIC CONNECTING SYSTEM FOR THE PURPOSE OF TELECONTROL; M. Schuler, Gottingen, Germany. App. filed March 8, 1924.

1,648,916. THEFT-PROOF LAMP BULB; L. Schmidt, Jr., Brooklyn, N. Y. App. filed Oct. 30, 1926.

1,648,921. ELECTRIC PIPE WELDING METHOD AND APPARATUS; I. J. Van Huffel, Warren, Ohio. App. filed April 14, 1926.

1,648,948. SPRING REEL; B. G. Johnson, Brookfield, Ill. App. filed Aug. 4, 1923. Conductor take-up reel.

1,648,957. ELECTRIC SIGN; H. Mock, New York, N. Y. App. filed Oct. 7, 1922. Having the individual letters formed of a continuous single strand of non-oxidizable resistance metal exposed to the air.

1,648,963. ELECTROLYTIC CELL; E. Romanelli, Bloomfield, N. J. App. filed July 30, 1926.

1,649,011. CIRCUIT BREAKER; A. H. Bakken, Edgewood Park, Pa. App. filed Nov. 26, 1920. Operating mechanism for either automatic or manual operation.

1,649,018. CONTROL APPARATUS; A. H. Candee, Forest Hills, Pa. App. filed May 11, 1921. For motors.

1,649,023. COMBINED COCK AND SWITCH; C. C. Farmer, Pittsburgh, Pa. App. filed Feb. 13, 1926. In which the switch is controlled by the movement of the cock.

1,649,024. RANGE SWITCH ASSEMBLY; F. F. Forshee, Mansfield, Ohio. App. filed Dec. 29, 1925.

1,649,030. SWITCH MECHANISM; W. E. Harrison, Philadelphia, Pa. App. filed Oct. 18, 1920. Inclosed switch.

1,649,034. HIGH-SPEED CIRCUIT INTERRUPTER; R. Longstädt, Berlin-Schoneberg Germany. App. filed Sept. 8, 1925.

1,649,035. DISCHARGE GAP DEVICE; J. L. McCoy, Pittsburgh, Pa. App. filed Dec. 29, 1925.

1,649,038. AUTOMATIC STATION; C. McL. Moss, Pittsburgh, Pa. App. filed March 14, 1921. Transfer system for the control of a plurality of converters.

1,649,048. TRANSFER SYSTEM FOR AUTOMATIC STATIONS; R. J. Wensley, Edgewood Park, Pa. App. filed Aug. 15, 1922. For the control of a plurality of converters in such stations.

1,649,059. ELECTRIC SWITCH; F. C. Davis, Toronto, Ontario, Canada. App. filed March 27, 1926. For use in the operation of electrically controlled elevators.

1,649,067. ELECTRICALLY HEATED CUP AND METHOD OF PRODUCING SAME; J. H. Karlson, Chicago, Ill. App. filed July 13, 1925.

1,649,094. ALLOY; P. H. Brace, Wilkinsburg, Pa. App. filed Nov. 16, 1921. For use as lead wires for glass vacuum apparatus, such as lamps, vacuum tubes and the like.

1,649,111. INSULATOR; W. F. Grimes, Washington, D. C. App. filed Feb. 8, 1922. Suspension or strain type for high-frequency circuits.

1,649,125. SYSTEM OF DISTRIBUTION; J. F. Peters, Edgewood Park, Pa. App. filed May 24, 1923. Constant-current system.

1,649,136. AUTOMATIC BATTERY-CHARGING AND VOLTAGE-REGULATING SYSTEM; E. D. Smith, Chicago, and W. H. Perkins, Oak Park, Ill. App. filed May 27, 1922.

1,649,150. LAMP CONSTRUCTION; W. J. Cameron, Chicago, Ill. App. filed July 19, 1926. Miniature lamp designed for use by physicians.

1,649,168. SELECTING DEVICE; L. L. Ladd, Lockport, Ill. App. filed Oct. 17, 1921. Selective control.

New Trade Literature

FURNACES.—The W. S. Rockwell Company, 50 Church Street, New York City, is distributing bulletin No. 285, which describes and illustrates the modern electric and fuel furnaces of the car and car-and-roll type for the heat-treatment of metal. A technical description of different forms of these furnaces, with an outline of the field of usefulness and limitations of the different designs, is included.

ECONOMIZER AND FEED-WATER HEATER.—Bulletin EC102 issued by the Foster Wheeler Corporation, successor to the Power Specialty Company and the Wheeler Condenser & Engineering Company, 165 Broadway, New York City, gives an outline of the uses of the Foster economizer for recovering waste heat from boiler-flue gases. The company is also distributing bulletin No. 120, describing and illustrating the Wheeler feed-water heaters.

MAGNETIC BRAKES.—"When Industry Says Stop" is the title of catalog P-38 issued by the Cutler-Hammer Manufacturing Company, Milwaukee. The catalog gives in detail the construction and operation of all types of magnet brakes, both for alternating and direct current, and also contains tables showing the exact size and type of brake for use with the various types of mill and crane motors.

ASH GATES, ASH HOPPERS AND FURNACE BOTTOMS. — The Atlas Conveyor Company, 20 South Fifteenth Street, Philadelphia, is distributing a bulletin which describes and illustrates the Atlas ash gates, ash hoppers and furnace bottoms.

A PROTECTIVE COATING FOR POWER-PLANT EQUIPMENT. — Bulletin No. 1132 issued by the Dampney Company of America, Hyde Park, Boston, describes the uses and application of "Apexior" No. 3 for hot-dry or cold-wet metal surfaces, such as boiler fronts, piping, cold-water tanks, etc.

NICKEL-ALLOY STEEL. — The International Nickel Company, Inc., 67 Wall Street, New York City, is distributing bulletin No. 11, containing notes on the machining of alloy steels.

EQUIPMENT FOR RAILROADS.—Bulletin No. WP-1000 issued by the Worthington Pump & Machinery Corporation, 115 Broadway, New York City, describes and illustrates equipment for railroads.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Sydney, Australia (No. 28,332), for electric buffers for use on automobile bodies.

An agency is desired in Prague, Czechoslovakia (No. 28,331), for elevator control apparatus and light signals.

Purchase or agency is desired in Toronto, Canada (No. 28,367), for electric heaters and humidifiers.

An agency is desired in Rome, Italy (No. 28,330), for hydro-electric plant equipment and electric motors.

Purchase and agency are desired in Milan, Italy (No. 28,358), for electric insulators for high voltage transmission.

Purchase and agency are desired in Vancouver, Canada (No. 28,323), for electric lighting fixtures.

An agency is desired in Buenos Aires, Argentina (No. 28,346), for electric washing machines.

Purchase is desired in Milan, Italy (No. 28,359), of enameled copper wire, X-ray apparatus and supplies.

G. A. Hutchinson of Levin & Company, Ltd., Wellington, New Zealand, who is planning a visit to this country, is interested in getting in touch with manufacturers of electric dishwashing machines. Communications may be addressed to Mr. Hutchinson through the Electrical Equipment Division of the Department of Commerce, Bureau of Foreign and Domestic Commerce, Washington, D. C.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

Water-Power Countries Lead in Use of Electrical Energy

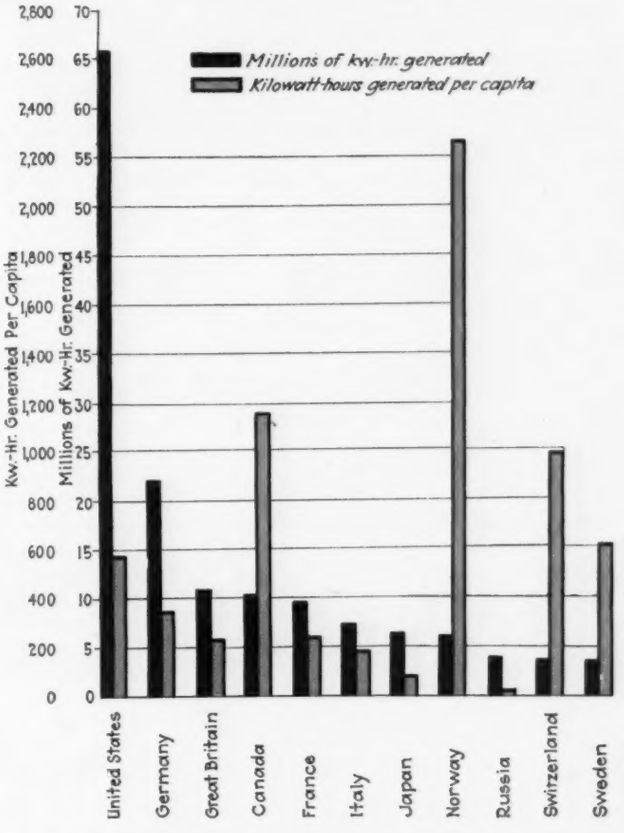
HOW do the various nations of the world rank in the use of electrical energy? How do they rank in consumption per capita? To answer these questions is not as easy as it might seem. An authoritative comparison presupposes authoritative statistics, and those have to be collected officially by the countries concerned.

The chart is plotted from data presented at the Economic Conference in Geneva last May. The report of that conference states that "official statistics on energy generated are available only for comparatively few countries . . . in particular the United States, Canada, France and Italy. . . . Even these comprise only the energy transmitted from public stations. . . . But what is most of all lacking is any indication of the purpose for which power is used." It might be added that the United States does collect statistics on the electrical horsepower installed in manufacturing establishments, but not on the energy generated or consumed in that connection.

In total output the United States is far in the lead, with 40 per cent of the world's production. Next comes Germany, then Canada and Great Britain close together, followed by France. When we come to per capita figures, however, the value of abundant water power, if developed by a progressive people, shows up conspicuously in the predominant rank of Norway—about 2,200 kw.-hr.—followed by Switzerland and Canada. The United States comes fifth. The inference that hydro-electric energy is a leading factor in bringing about a large use of electrical energy is supported by experience in the United States. Several of our Western states, where water power is abundant, rank only a little below Norway in their output per capita. Under those conditions electrical energy is liberally used in power-consuming industries and in transportation.

Since official figures for public utility plants were used in the cases of the United States and Canada, whereas estimated total production is taken for the other countries, the various statistics do not strictly correspond; inclusion of energy generated in other than public utility plants would increase the output of each of the countries named by perhaps 20 per cent and would put Canada ahead of Great Britain in output, but would leave unchanged the rank in output per capita.

It may come as a surprise that in this era of counting and measuring, of trade statistics and tariffs and commercial treaties, of government supervision, corporations and cartels, of League of Nations economic conferences and International Chamber of Commerce meetings, data on the generation of electrical energy should not be available for all the important countries, at least, on the face of the globe. Nevertheless that is the fact. Nation is balanced against nation as to exports and imports, as to production of sundry commodities, and as to material natural resources, but the one common constituent of all modern manufactured articles, energy, the abundant use of which has brought about the industrial epoch and in a generation has radically changed the lives of mankind, still goes to a considerable degree unmeasured in many countries. Fortunately, the estimates, where those had to be made, are probably reasonably accurate and will at any rate serve for comparisons.



The United States Leads in Energy Generated, but Ranks Fourth in Output Per Capita. Data Are for 1925

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Rate of Production in New England Continues Upward Trend

OCTOBER witnessed a continuance of the upward trend in the productive activities of the manufacturing plants of New England, a trend which started in August. The October activity was 2.7 per cent over September and 6.7 per cent over August, but was 3.8 per cent under the activity recorded in October last year. This is the second consecutive month that the rate of general production in this section has been under that recorded last year.

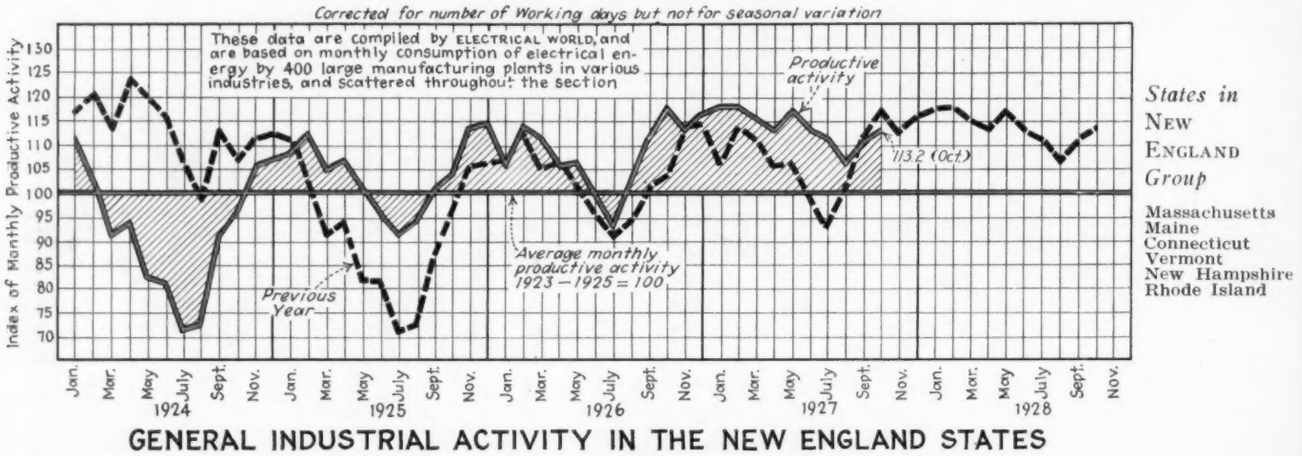
During October only one of the New England primary industries—leather and its products—witnessed productive activities over those reported for October, 1926. The textile plants of the section, which have been operating at a rate above that of the same month of the year previous ever since November last year, reported October activities 1.4 per cent under October last year. Other industries, while maintaining a comparatively high rate of activity, have not recorded the upward trend which is normally to be expected at this season of the year. It seems probable that the New England manufacturing plants as a whole will close the current year with activities slightly under the same period last year.

Indexes of Productive Activity in the New England States

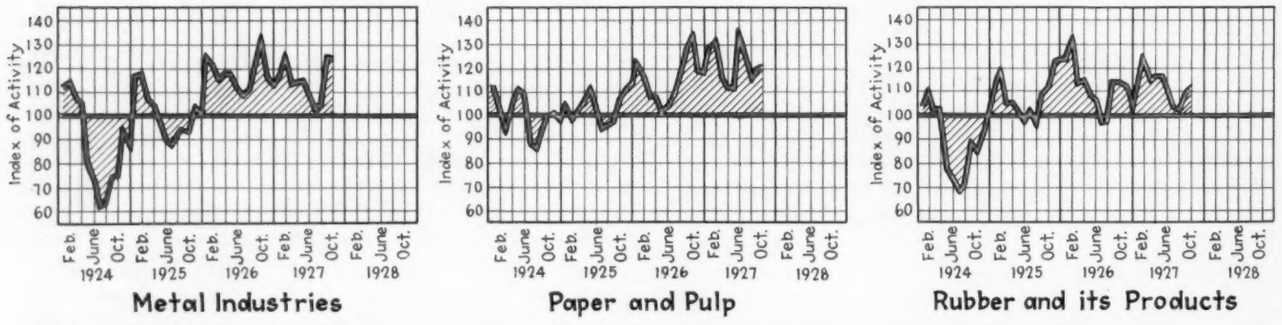
All Figures Adjusted for Number of Working Days

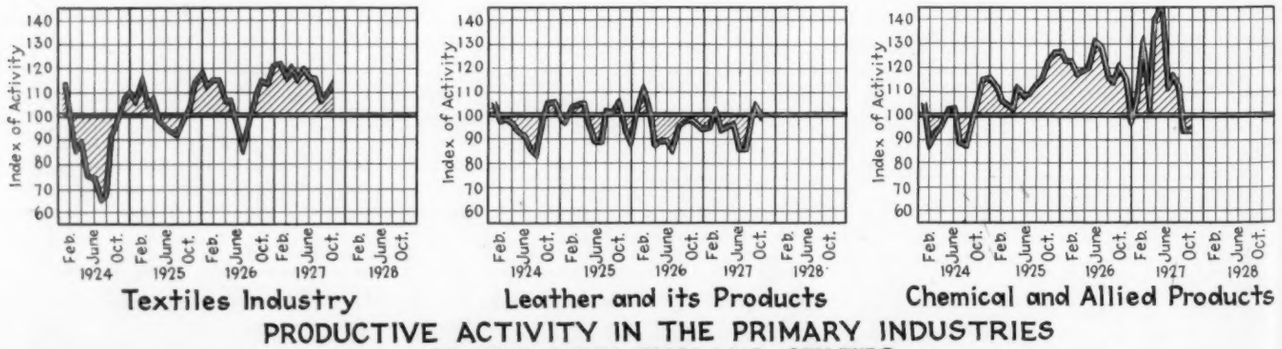
	Oct., 1927	Sept., 1927	Oct., 1926	Average for First Ten Months of 1927	Average for Full Year 1926
All Industries:	113.2	110.2	107.8	113.4	107.8
Chemical and allied products	92.2	93.7	121.2	117.1	118.8
Leather and its products	99.7	104.2	99.2	95.4	96.0
Lumber and its products	113.2	134.6	...	...	...
Metals group	124.6	126.0	130.5	115.6	117.8
Paper and pulp	120.5	119.5	133.4	121.1	115.5
Rubber and its products	111.2	109.4	114.0	112.3	111.5
Textiles	114.7	109.2	116.4	115.5	107.4

ELECTRICAL WORLD *Barometer of Industrial Activity in the New England States*


Corrected for number of Working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Productive activity
113.2 (Oct.)
Average monthly productive activity 1923–1925 = 100
Previous Year
Index of Monthly Productive Activity
States in NEW ENGLAND Group
Massachusetts
Maine
Connecticut
Vermont
New Hampshire
Rhode Island
1924
1925
1926
1927
1928

GENERAL INDUSTRIAL ACTIVITY IN THE NEW ENGLAND STATES





PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NEW ENGLAND STATES